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GEOGRAPHY.

LIFE AT TIMBER LINE.

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I have been asked to communicate to the Kansas City Academy of Science a narrative of my experience in the Rocky Mountains, so far as the latter may seem to me to possess general interest for an audience of the character assembled here.

It has not been practicable, in consequence of my absence from accumulated data, to prepare a careful scientific paper for this occasion; and I, therefore, merely design stating from memory in a conversational way, some matters that present themselves in the general mass of recollections growing out of a residence embracing portions of five years—and covering nearly four years of continuous time—at the summit of the Sierra Madre, in Southwestern Colorado. In what I have to say, I shall confine myself to the Summit Mining District and to facts and occurrences personally observed.

The location to which reference is made is most widely known as the Little Annie mining camp, and is situated near the base of South Mountain in Rio Grande county. More definitely, the point is in N. lat. 37° 28′ 18″, near W. long. 106° 30′, and according to Lieut. Wheeler, 11,300 feet above tide. It is almost accurately in line with Syracuse, the most southern city in Europe, and is at the same distance from the equator as Melbourne, the most southern city in the world. Although the Annie camp is everywhere known as "the Summit," it is, in fact,

situated in the trough of a synclinal marked on the south by South Mountain 12,500 feet, and on the north by Summit Peak (the Mt. Belleview of Hayden's Drainage Map of Colorado) 12,748 feet high. At the triangulation monument on the latter, may perhaps be had as vast and impressive a mountain outlook as can be found in the United States. Besides a number of peaks over 13,000 feet in altitude, showing on their upper slopes, during the whole summer, snow fields which have probably presented nearly the same general mass and outline in July and August every year since the Jewish exodus, there rises in clear view 65 miles northwest, the giant form of Uncompahgre, 14,205 feet elevation; and 64 miles East, Blanco Peak, the loftiest pile over which that unhandsome fowl, the bald-headed eagle, can fly and be at home, 14,464 feet above the sea. For a hundred miles in every direction, over Colorado and New Mexico, and perhaps into Utah and Arizona, the eye surveys the mightiest monitors of telluric disturbance in America north of the Mexican line.

On the 29th of July last, the solar eclipse of that date was observed from the monument on Summit Peak under instructions from the Signal Service Office at Washington. I wish I could convey to you in adequate words the weird vision that swept down from the northwest through the pulseless stillness, of the upper air over the frozen rock billows of the upper lands. But I believe that neither Starr, nor Clarence King, nor John Ruskin—the three men in whom the changeful glories of the mountains have most truly voiced themselves, could do that. I certainly shall not try.

The day of the eclipse was the only occasion when I have known the air at rest as high up as 12,000 feet. It was a favorable circumstance, as were all others connected with the observation.

Since August 1st, 1876, careful meteorological records have been kept at the Little Annie office. They have been as comprehensive as instrumental means allowed. Although the loftiest station except Pike's Peak reporting to General Myer, being a "volunteer," it has unfortunately been without automatic registering appliances of any kind, without barometer, anemometer or psychrometer, without meteorological tables, and several other desiderata. The absence of these has confined observations mainly to temperature, precipitation, sky readings, estimated air movements, and casual phenomena.

Before giving a brief abstract of climate at 11,300 feet in the latitude of Richmond, Va., let us consider the most important factor in that of the Summit, viz.: elevation. The equivalent of altitude for latitude is approximately expressed by saying that every 1,000 feet of elevation corresponds to a removal of 3° of latitude from the equator. This rule would add (climatically) 34° of N. latitude to the geographical position of the Summit. 37° 28′ 18″ + 34° = about 71° 30′ N. Now, if you will consult an atlas, you will find that this takes you a considerable distance toward the pole; about 5° inside the Arctic Circle. The line passes to the north of every settlement made by man in Europe and Asia; and north of all except Upernavik, in America. When, however, we get as far as this toward where the meridians meet, we are not quite certain of our rule.

I do not know if weather records are kept at Upernavik, and think a nearly six months' absence of solar rays likely to lower the annual average of temperature beyond the reading of the scale given. Still, we have at the Little Annie, the loftiest gold mine worked on the globe, an Arctic climate, as distinctly marked by its fauna and flora, as by the monthly and annual averages of the spirit thermometer.

The following is a brief of temperature and precipitation at the Summit Signal Station during the twelve months ending June 30, 1878:

MONTHS.	TEMPERATURE.			TOTAL RAIN &	TOTAL
	MEAN.	MAX.	MIN.	MELTED SNOW	SNOW-FALL.
July 1877	52.8°	69°	43°	3.6 inches	0. inches.
August . . . . . "	51.5	63	43	2.44 "	1. "
September . . . "	43.0	61	26	3.7 "	11.5 "
October . . . . "	27.5	52	2	4.4 "	44.0 "
November . . . "	13.7	42	—24	0.9 "	9.2 "
December . . . "	10.3	40	—22	1.0 "	10.0 "
January 1878	6.3	32	—21	0.7 "	7.0 "
February . . . "	6.0	32	—18	2.96 "	29.6 "
March . . . . . "	17.1	48	—12	5.6 "	55.75 "
April . . . . . "	22.9	48	—2	5.125 "	51.25 "
May . . . . . "	31.5	54	14	1.3 "	13.0 "
June. . . . . "	40.8	66	26	2.985 "	14.52 "
Sums.	323.4	605	55	34.710	246.82
Means.	26.95	50.4	4.58		

Compendiously stated, the highest temperature reached during the year was 67°+ Fahr., the lowest 24°—, the mean of maximum temperatures was 50°.4+, the mean of minimum temperatures was 4°.6+, and the average annual temperature 5° below freezing point.

Snow has occurred during every month save July since observations began, 29 months ago. *Last* July furnished us with two considerable snow storms, and the column of snow-fall in the *next* annual summary will be unbroken. Hail is frequent during the summer, and few nights pass without frost. Winter begins about the 5th of September and ends about the 10th of June. We have no spring or autumn. Twice the amount of snow falls in March, April and May that reaches us in December, January and February. The annual crop of "the beautiful" is about 24 feet.

I will say here, that the thin, almost vapor-void atmosphere at 12,000 feet altitude is scarce ever *chilly*. When the temperature rules as low as 10° below zero, the air is generally still. In over 400 miles of travel on snow shoes I have never worn an overcoat or an overshoe, and have rarely felt as cold as I have, heavily dressed, during the present week in Kansas City. The upper snow is like corn meal, light and dry; it rarely gives in melting over 1-10 its bulk of water. At all seasons, the ground below the surface is frozen to an unknown depth; no excavations in mines or elsewhere having passed the line of perpetual congelation.

The 4th of July, 1877, was celebrated at the Summit by a snow shoe and

snow-balling party, in which seven individuals present in this hall participated. Four of them, who had been accustomed for a number of years to fan themselves and fight mosquitoes in the woods of Staten Island on that date, will recognize one marked exception to their previous thermal experiences in endeavoring to commemorate the adoption of Mr. Jefferson's essay. An account of the unique doings on that occasion of these stray Staten-Islanders, was published by the Chief Signal Officer of the Army in his Weather Review for the month named.

From the middle of November to the middle of June, extensive outside locomotion is limited to snow-shoeing. The latter is performed on runners of the Norwegian pattern, and their facile use involves considerable dexterity. When one first mounts two strips of timber 10 to 12 feet long, and tries to stand up on them going down a gravity-impelling grade—one is apt to encounter unexpected experiences. Somehow, one or the other leg is sure to get irretrievably in advance of its mate, and there is a capsize, a *bouleversement* of the entire animal economy. This does no harm to the novitiate who is wrestling with snow shoes, and is productive of inexpressible and prolonged cachinnation to the lookers-on. Snow-shoeing is grand sport; better than skating and devoid of its dangers. It works no bodily ill to be shot into three or thirty feet of snow. There is little danger of bone-fracture, and none of drowning. The best "snow shoe man" that ever came under my observation, was a woman; graceful as a bird in flight—and good for twenty miles an hour on a hard track and sharp grade. The Canadian or web-foot snow shoe is not, save occasionally by new comers, in use in the mountains.

Snow-slides, in immense masses, occur during the spring months. Where they strike the heaviest timber, or the firmest structures—the latter are literally shaved from the ground as by some cyclopean mower. For many years the track of one near the Summit will be visible, where in a heavier forest than there is in Missouri, a road a hundred feet wide and half a mile long, has been cut as straight and clean as any street in Kansas City.

Of casual phenomena, the number of "cloudless days", (I use the term strictly—days when from sunrise to 9 o'clock P. M. there is not a filament of cirrus on the concave,)– is perhaps the most remarkable. Fourteen of them were noted during the twelve months ended 31st July, 1877. On the 11th, 12 and 13th of August 1876, the sun, moon, and several stars, were visible from 10 o'clock A. M. to 2 o'clock P. M. On the evening of the 4th of the same month, perhaps the most splendid lunar rainbow ever witnessed, was exhibited to the dwellers on the Summit. It appeared about 9 P. M., the moon being full, and lasted fifteen minutes. The chromatic scale was complete in the primary, and the secondary arc was perfectly defined around the entire semi-circle. The upper outlines of the mountains were but faintly discovered through the blackness of the storm, while the valley of the North Alamosa was flooded under the arch with an inundation of intense but indescribable light; brighter than that under the most brilliant aurora, but golden. As no words can convey such a picture, we were fort-

unate in having present at the time an artist who has perpetuated the scene in colors that will not fade.

Of parhelia, we have about half a dozen striking exhibitions annually. Meteors are frequent. Paraselenes, aurora borealis, and mirage, have not been observed.

Repeating that on the Sierra Madre in Southern Colorado we have two seasons—summer, where it rains almost daily—and winter, in which a large majority of the days are clear,—I dismiss matters of situation and climate.

It is known to you that the Rocky Mountains represent the latest extensive line of out-thrust and disruption on the earth's surface.

The main axis of the Saguache range is felspathic porphyry, intercalated with occasional granite and trap. The only fossil yet seen in the Summit Mining District is a tree trunk silicified and partially carbonized, lying at over 12,000 feet elevation,—of tertiary or later origin. A narrow seam of impure coal is found near by.

First of existing fauna comes *Ursus ferox*, (Var. cinnamom) the largest native mammal on our side of the world. Next is *Felis concolor*, or mountain lion, —the most formidable of the American cats. Then follow the black bear, elk, mountain sheep, mountain wolf, red, black and cross fox, porcupine, ground hog, fisher, marten, rabbit, squirrel, weasel, coney, chipmunk, mountain rat, mouse, and mole. Of birds, we have hawks, owls, ducks, grouse, quails, doves, ravens, black birds, snow birds, camp robbers and woodpeckers. Of insects, the cosmopolitan horsefly and musquito, the bumble bee, honey bee, locust, spider, gadfly, white and yellow butterfly, hornet, and several species of myriopoda. There are no snakes on the ground and no fish in the waters. Leeches have been the only living thing found in the latter. Careful search for snails has not produced a helix.

The magnificent forests of spruce and fir that meet across the gulches and rise at 12,100 feet to timber line, must have foremost mention in any view, however brief, of the Alpine vegetation of the Summit. I counted upwards of 400 annual rings in one of the "forest monarchs" felled for a battery sill in the Annie mill, and gazed with the brief wonder of an ephemeral existence on a life ended before its time—that yet had braved the tempests of four hundred Summit winters—that sat serenely under Summit skies when Columbus was a boy, and had replanted its race before Luther was born. Forests covering thousands of square miles that will cut 40 to 60 cords to the acre, are not the least of the gifts of the Great Hills. We all owe a grateful debt to Secretary Schurz for his initiative in regard to the spoliation and waste of timber on the public lands. If the latter is suffered to go on unchecked for a few generations, it will turn the western plains, which the labor of man is converting from a desert into a garden, back to a desert again. The forests do well enough without man—but man cannot live without the forest.

Every plant at the Summit over six feet high is a conifer—an evergreen. All, spruce and fir. Even the pine is not found within 2000 feet vertical distance

from the Annie camp; it climbs only to the line where *Populus Tremerloides* marks the upward limit of deciduous trees. The undergrowth is almost entirely a dwarf variety of salix.

Of flowers, I can speak only generally and briefly, They come up and bloom through the wasting snow about the 30th of May, and disappear about the end of August. For nine or ten weeks the mountains are a garden; the ground glorious with intense and contrasted color. Helianthus and rosa flanda, gentians, daisies, columbines, cowslips, larkspurs, blue bells, and I know not what else, combine to form a flora which if less gorgeous—cannot truly perhaps be called less beautiful—than that of the tropics. During three summers, industrious and careful collection was made; and I have in Ohio the material for five comprehensive herbariums, which material Dr. Geo. T. Engelmann of St. Louis has kindly consented to classify and name.

Epiphytes, Filices, and Graminea, are well represented at 12,000 feet; the latter largely—and our mountain men agree with the Savoyards in affirming that the highest pastures grow the sweetest and most nutritious grasses.

Of wild berries we have the currant, huckleberry, gooseberry, strawberry, and juniper.

On the 14th of June last—as early as the sunniest spot at 11,300 feet was clear of snow, we broke ground for an experimental garden. On 1st October, we made up the account with the following result: Radishes (roots) grew to be 5 in. long and ½ in. thick. Turnips to be ¾ in. in diameter. Maize (stalks) to be 3 in. high. Mexican beans, ditto. Peas 5 in. high, and blossomed; no fruit. Potato stems grew to be 6 in. high; longest diameter of tubers ¾ in. Beets (roots) 4 in. long and ⅛ in. thick. Kohlrabi and parsley did not come up. Nasturtiums grew to be 1½ in. high. Spinach and lettuce grew 3 in. high, and kept green for weeks after all the rest were dead.

Here, at the end of my time, though not at the end of material, I close this brief resumè of Upland life. It seems on looking back, an almost weird intercalation in the years. The attitude, the seclusion, the great mountains, the snow-shoe locomotion, the thin air, the entire absence of other than grateful warmth—all the surroundings of an Arctic residence—are like a dream, here at 700 feet over tide. To no one physical feature of our globe does man owe more than to its mountain ranges. Mineral treasures are the least of their contributions to his service. They are sources of life to all below. The increasingly larger knowledge of their relations to climate, to timber-line, to the growth of cultivated plants, to the well-being of useful animals, to storm origin and distribution, to rain-fall and river supply—is constantly investing them with new titles of beneficence.

In all ages they have been nurseries of political and intellectual freedom for mankind. The civilization of Europe and America was born at the feet of the Himalaya with the Aryan race, two miles above the level of the sea. Wherever there is a land favored by nature with a mountain-chain, its inhabitants will make a history, and reflect in personal and national character, somewhat of "the strength of the hills".

I thank you for your attention.

OBJECTIONS TO MARKHAM'S NEW ROUTE TO THE POLE.

At the regular monthly meeting of the British Royal Geographical Society, of December 16th, 1878, Mr. Clements Markham read a paper on a proposed new route for Polar Exploration, *via* Franz Joseph Land, which elicited the following comments from Dr. Rae, a gold-medallist of the society, and well-known as an experienced Arctic traveler and student.

"We are told: First, that a high northern latitude might be attained, and valuable discoveries made along the western shores of Franz Joseph Land, which may be presumed "to be free from ice, as are those of Spitzbergen." Secondly, that the safest and best route by which to reach the west shores of Franz-Joseph Land is somewhere in the meridian of 44° E.—that is, nearly equidistant from Spitzbergen on the west and Novia Zemlia on the east.

Agreeing fully with the first of these opinions—namely, that a high northern latitude could be reached along the west shore of Franz Joseph Land—views not by any means new to me, as I brought them to the notice of the geographical section of the British Association at Dublin about four months ago—I am wholly at variance with the writer of the paper as to the best route by which to arrive at the desired locality.

He tells us that the best season to navigate icy seas, on the route he recommends, is towards the end of August and in September—at a time, in fact, when winter in high latitudes is about to set in—and mentions as his reasons for this choice the fact that one of several Arctic explorers, whom he names, reached latitude 78° 48′ in the meridian of 44°, leaving the audience to infer that there was something very wonderful in getting so far to the north; whereas many of the Arctic navigators of our own and other countries have gone much further North with sailing vessels in the meridian of Spitzbergen (in which Nordenskjold is made to say no useful end could be gained), by passing along its western shores.

Besides the lateness of the date at which the meridian of 44° is found to be navigable, there is another disadvantage in this route, which must be obvious to all thinking men in any way conversant with the subject.

The relative positions of Franz-Joseph Land, Spitzbergen, and Novia Zemlia, forming as they do three sides of a square, indicate that a passage through the inclosed space must in general be difficult and dangerous, because any strong winds from east, west, or south must press the ice-pack forcibly against one or other, and expose explorers to the same disaster that happened to the Austro-Hungarian expedition in 1873-4.

We know by the experience of centuries that the sea along the west coast of Spitzbergen is almost always navigable for two or more months, and I was extremely surprised that not a word was said about the expedition of Parry—the greatest of all Arctic navigators, living or dead—in 1827, half a century ago, to the north of Spitzbergen, when he got in his sledge boats, as high as 82° 45′ N., and, but for the untoward southerly drift of ice, would have reached a position farther north than that attained by a recent expedition up Smith's Sound.

A few extracts from Parry's narrative, every word of which bears the stamp of truth—a characteristic of this good and noble sailor—will explain, better than anything else can, the state of the ice in the high latitudes on the "meridian of Spitzbergen," and show how easily steamers of the present day could on that occasion have pushed their way among it.

With the sailing ship Hecla Parry reached latitude 81° 6′ N. about the middle of June, when they found "loose sailing ice to the northward"; the latitude reached in the meridian of 44° being 78° 48′ (or 138 miles less far north) on the 31st of August, as given in the paper read on Monday:

June 16, page 46.—Had a clear and extensive view of the Seven Islands, (latitude 80° 45′, longitude 21° E.), and saw land far beyond them to the eastward.

This far land probably forms one of the Franz-Joseph Land group. Finding no safe harbor near the Seven Islands, Parry ran southward to latitude 79° 55′, and secured his ship in Hecla Cove on June 20, having to saw a passage through the still unbroken ice in the bay.

When going northward in his boats, he tells us, at pages 99 to 101:

As usual, we were much annoyed by the numerous loose pieces over which we had to pass; but, a large portion of these being flat bay ice, we made tolerable progress. At 11 p. m. we could see nothing before us but this thin ice, much of which was not fit to bear the weight of our boats and provisions.

By our observation at noon we found to our great mortification that our latitude was 82° 36′ 52″, being less than five miles to the northward of our place on the 17th, since which we had traveled twelve miles in that direction.

July 22.—Our disappointment was great on finding that we were in latitude 82° 43′ N., or not quite four miles to the northward of yesterday's observation, instead of the ten or eleven miles we had traveled.

July 25.—So small was the ice now round us, that we were obliged to halt for the night at 2 a. m, being on the only piece of ice in sight in any direction on which we could venture to trust our boats. Such was the ice in latitude 82° 45′ north!

July 26.—Our latitude to-day was 82° 40′ 23″, only one mile north of our place at noon on the 21st, though we had estimated our distance made good at twenty-three miles—a loss of twenty-two miles by drift in five days!

No sailing vessel could have made headway against this southerly drift of the ice during calm or moderate weather, the most favorable for ice navigation; whilst there cannot be a doubt but a powerful steamer, such as those used at present as whalers and sealers from Peterhead and Dundee, would have found little difficulty in pushing through it.

Page 148.—The Hecla, in the beginning of June, sailed about in the neighborhood of the Seven Islands without obstruction, and before the close of July not a piece of ice could be seen from Little Table Island, latitude 80° 48′ N!

I may add, in conclusion, that before the middle of August, when we left the ice in our boats, a ship might have sailed in the latitude of 82°, almost without touching a piece of ice; and it was the general opinion that by the end of the

month it would probably have been no difficult matter to reach the parallel of 83°, about the meridian of the Seven Islands [which is the same as that of Spitzbergen].

Why the experience of the distinguished man from whose narrative I have given a few quotations was wholly ignored in the last paper read on Monday, and why the result of a voyage leading only to latitude 78° 48′, at so late a date as the end of August, was brought so prominently forward, I must leave your readers to infer. It is not far to seek.

When getting up the Smith Sound expedition, it was the fashion to assert that no land lay to the north of Spitzbergen, or, if there was any, it consisted only of small islands. I, on the contrary, from the time when I read Parry's narrative many years ago, believed that the great quantities of thin ice seen by him came from bays and inlets far north, which, being sheltered from pressure caused by winds and currents, break up later than the more exposed flows.

On looking over this narrative of Arctic work in 1827, I am surprised at the immense loads the men had to haul, and their very small rations of food. Including the officers as workers, each man had a weight of 268lb. to haul; but, excluding the officers, the loads were, with the sledges, 320lb. each; whilst the rations were only 10 oz. biscuit, 9 oz. pemmican, 1 oz. sweetened cocoa, and 1 gill rum per man per day. Parry says they were sometimes very hungry—no wonder!—and he occasionally issued 1 oz. biscuit and 1 oz. pemmican extra. They had carried with them provisions for seventy-one days.

Permit me to add that Mr. B. Leigh Smith, in 1871, with his sailing yacht Sampson, after traversing 17 degrees of longitude to the north of Spitzbergen, in latitudes from 80° to 80° 30′ N., and making some valuable contributions to our geographical knowledge by new discoveries and corrections of positions, sailed northward, and on September 11 reached latitude 81° 25′, being 157 miles further north than the position (78° 48′) mentioned by Mr. C. Markham as having been attained by Payer, on August 31 in the same year, on the meridian of 44° east.

RELIEF FOR NORDENSKJOLD.

Dr. M. Lindemann, secretary of the Geographical Society of Bremen, writes to Capt. Howgate under date of January 11th, 1879, that this year an expedition will be sent out by an honorary member of the Society, Mr. Sibiriakoff, by way of the Suez Canal and Indian Ocean, to Bherings Strait—in search of Nordenskjold. The steamer of 350 tons burden, is to be built at Malmö, and will be commanded by Mr. Henry Sengstacke, an excellent seaman of great Arctic experience, who was first officer of the Germania in 1869-70. It is expected that a small scientific corps will accompany this expedition.

Besides the vessel now fitting out at the expense of M. Sibiriakoff for the rescue of Professor Nordenskjold, and James Gordon Bennetts' ship, the Jeannette, a Russian man-of-war is to proceed immediately with assistance to the

Swedish expedition. Orders have been transmitted by the Russian Admiralty for the Abrek, of the Imperial Russian Navy, to go to Behring's Straits in search of the explorers. The Abrek will call at Kamtschatka for Esquimaux, with their sledges and dogs, and then push northward.

The following letter has been received from M. Sibiriakoff:

"I am very glad to hear the Jeannette will be sent through the Behring's Straits, and that she will render every assistance in her power to Professor Nordenskjold. I will send my steamer, the Nordenskjold, which will be ready on the 10th of May next, through Behring's Straits, for the mouth of the Lena. I hope, however, that the American vessel will pass the Straits as soon as they are practicable, and will render this assistance unnecessary. I shall try now to rescue Nordenskjold by land."

CHEMISTRY.

CHEMISTRY IN THE ARTS.

BY PROF. G. E. PATRICK, UNIVERSITY OF KANSAS.

(*Extracts.*)

In the iron industry chemical science has of late years played an important role; without it the iron master would have been like the captain of a rudderless vessel; he might have pushed blindly forward, but would have been without means to guide his course.

Although chemistry has lent her indispensable aid and guidance to the whole iron industry, it is in the art of steel making that she has done especial service and won her highest honors. Analysis long ago established the rule, that wrought iron to be of good quality must not contain more than .5% of carbon; that a good steel may contain .5 to 2% of that element and that a cast-iron may hold any amount between 2, and 6%, and be of fair quality; it also showed that it is just this varying amount of carbon that determines the leading properties of a piece of iron—determines whether it shall be called *cast iron, wrought iron, or steel.*

Analysis showed steel to be a mean between the two extremes, cast and wrought-iron, as regards their per centage of carbon. Now, the old method of making steel—a very good one for the sleepy days of twenty years ago, young America would say, but rather slow for these—was to take bars of wrought-iron, pack them in powdered charcoal, and expose them, thus encased, to a furnace heat for a time varying between ten and twenty days; they were then taken out as steel, the carbon having gradually entered the bars and forming a chemical union with the iron. The time of heating in this charcoal bath depended upon the size of the bars, but even this was regulated largely by guess; there was nothing in the entire process, that in the most distant manner resembled scientific accuracy. But now, how wonderful the transformation! When was a grander e'er

beheld by mortal eyes or fairies'! The magic wand of science is waved and Ariel is at work. The Prospero that waved the wand, is Henry Bessemer; behold the results of his magic! They used to take 20 days for making steel; he made it in 20 minutes. They used to make steel in bars of a few pounds weight; he made with ease six tons in a single mass. They used to "guess" like the Yankee or "reckon" like the Southerner, that "maybe that charge of steel would likely have about enough carbon in it, in a day or two more, perhaps"; he could tell within five seconds when his steel was made, and within one tenth of one per cent. how much carbon it contained. In short, his method is a marvel of scientific precision.

(Here follows a description of the Bessemer process and reference to some of the results of the invention.)

Nowhere among all the chemico-industrial pursuits is there a better example of a thriving industry that has grown out of purely theoretical studies, than is found in the arts of dyeing and printing. I refer to the discovery—perhaps better the *creation*—of the host of brilliant colors that are now derived from coal-tar, and known under the general names of the aniline and the anthracene colors. In the history of these two groups, aniline and anthracene, with all their derivatives, is a lesson in characters so plain that he who runs may read; it is at once a lesson and a rebuke to the narrow-minded "utilitarian;" to him who is forever asking, "Of what practical *use* is all this study, all this scientific investigation?" and who speaks of the search for truth in the fields of abstract, unapplied knowledge, only to sneer at and denounce it. To him, if his brain be not too barren a soil for new thoughts to grow in, the history of these beautiful and useful compounds may suggest one or two pertinent queries: Who can tell what is really "practical" and "useful" knowledge? If this or that particular island of knowledge, in the great sea of ignorance, be of no great "use" to us, who can tell but it may be, to those who come after, the very island to save them from shipwreck?

Aniline has been known to chemists since 1826, when it was discovered among the products of the destructive distillation of indigo; it was subsequently made in small amounts by the decomposition of several organic substances; but there was no means known of making it in quantity until 1842, when M. Zinin prepared it in a manner that may be called *chemically beautiful*, by the action of nascent hydrogen upon nitro-bengol, a substance easily made from bengol (or benzin) which, in its turn, can be obtained in abundance by the distillation of ordinary coal-tar. Zinin rendered it possible to make aniline in great quantities, for coal-tar was then not only a valueless waste-product, but a positive nuisance in many cities of Europe. But at that time, aniline was in no demand, as its value was not yet known; and it remained for some years simply a chemical curiosity—one of the thousands of organic bodies brought into the world by synthetic chemistry. But a chemical curiosity in these latter days finds little rest in the chemist's hands; he straightway goes to work with oxidizing or reducing agents to bring forth from it, if may be, some new and strange offspring with

which his name may be coupled, and by which it shall be borne to posterity. It is this unceasing activity, this thirst for new conquests, this desire to pry further into things than all other men have done, that leads to nearly all discoveries, as it did to that of the aniline dyes.

(Here follows an account of the discovery of one or two of the aniline colors; then the artificial formation of alizarine from anthracene; then a few words about the beauty of all these colors; then the following words to close the subject:)

Right here, the afore-mentioned utilitarian might break in with "Pshaw! that's no discovery worth speaking of; only a few pretty colors, really good for nothing anyway." But here is another view which the utilitarian loses. Does not the whole world agree with the sage of Concord, that "If eyes were made for seeing, then beauty is its own excuse for being," and with that other greater genius, that "a thing of beauty is a joy forever?"

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The age of the alchemists is passed, and their profoundest thoughts upon the nature of matter and force are to us but the dreams of children; still, within the last few months, there has come to us from over the sea an announcement that recalls one of those same dreams of the alchemists—the dream of the transmutation of metals. The announcement is not, it is true, of the transmutation of a base metal into gold, but of a base earth, which we most commonly meet in ordinary clay, into something far more precious than gold; namely, the precious stones *sapphire* and *ruby*. The successful alchemists who accomplished this brilliant transmutation were two French chemists, Fremy and Feil; they did not, however, follow the blind empirical methods of ancient alchemy, but rather endeavored to find out and follow the methods of nature.

How has nature in her great laboratory, filled in general with so much coarse rubbish, succeeded in making, amid all this worthless stuff, those brilliant gems that sparkle here and there on the bosom of dear old Mother Earth? This *was* nature's secret, but it is her's no longer. By studying these gems their compositions occur at once, and the properties of their constituents. Chemists found out long ago that nature made her jewels out of the most common and homely material—mainly out of alumina, adding in some cases silica, or some of the metallic oxides; and further, that in the transformation of these earthy materials to their present brilliant forms, she has employed intense heat. For years it has been man's endeavor to imitate, in his laboratory, the methods of nature in her's; but, until a few months ago, his success has only been partial.

(Then follows the description of the method by which the two chemists referred to above have succeeded in making sapphires and rubies, identical in hardness, color and lustre with the natural minerals.)

The other achievement referred to, is that of the artificial preparation of vanilline, the aromatic principle of the vanilla bean, from a vegetable substance extracted from pine wood. This was accomplished in 1874 by two German chemists, Tiemann and Hoormann. It was the reward of months, perhaps

years, spent in the study of the composition, structure and properties of a substance which, by any sane person, would have been set down as a most unpromising subject to work upon with the hope of producing from it anything of use or value to mankind. But who can tell which sea-shell bears a pearl, which rose shall blossom, which shall die?

Vanilline, or, in other words, extract of vanilla, is now prepared on a manufacturing scale, from so humble and unpretentious a substance as pine shavings—a fact that should serve as a bond of fellowship and union between the carpenter and the cook!

PROFESSOR NICHOLS ON LOCKYER'S NEW THEORY.

We say new "theory" rather than new "discovery," because now that we have a semi authoritative statement concerning what Mr. Lockyer in his brief note to the Paris Academy asserted that he had "proved," it appears to be nothing more than a plausible hypothesis based upon his spectroscopic observations. The paper which had been heralded in so "sensational" a manner by this over-confident note, and by the extravagant articles on the subject in the *Daily Telegraph* and other London newspapers, was read to the Royal Society on the 12th of December. We expected to see it printed in *Nature* for December 19th, but found instead only the following brief note: "We have not received from the Royal Society the paper read last Thursday by Mr. Lockyer, in which he brought forward facts indicating the compound nature of the chemical elements. In the mean time, the following article from yesterday's *Times* may be of interest; it is evidently written by a chemist who was present when the paper was read." *Nature* for December 26th has since come to hand, but with no further reference to the paper. From the *Times*' article, however, which is thus indirectly endorsed by Mr. Lockyer, we are able to glean what were probably the main points of the paper.

To state the substance of it in the briefest possible manner, Mr. Lockyer, in the course of a long series of comparisons of the spectra of the metals with the solar spectrum, observed that certain lines re-appeared with singular persistency in the spectra, not only of one, but of several so-called elementary substances. These lines have been generally attributed to the presence of impurities in the substances under examination, but the scrupulous precautions observed to exclude every possible trace of contamination, and the continued recurrence of the same lines under varied circumstances, suggest the belief that they are not accidental, but essential; or, in Lockyer's own words, "the hypothesis that identical lines in different spectra are due to impurities is not sufficient." It seems a logical deduction from this that the metals in question have some constituent in common, and are therefore not elementary. Mr. Lockyer accepts this inference from his observations as if it "proved" his theory; but we need hardly say that he has "proved" nothing whatever. The most that can be conceded is that the

conclusions he has reached, and which are said to be "the result of a hundred thousand spectroscopic observations, which have taken six months to summarize," favor the supposition that the so-called elements are compound; that is, no other theory yet propounded accounts so well for the facts in the case as this does. But it is a theory, after all, and nothing but a theory; and it must be subjected to the same ordeal that all theories have to endure. It is perfectly satisfactory to its author, as new theories always are, but it must now run the gauntlet of scientific men with whom it is not a pet child, and who will show it no mercy if it cannot stand the tests they apply to it. How it will come out of the trial remains to be seen. Indeed, until we have the paper itself, and not a mere newspaper abstract of it, no scientific man will pass final judgment upon it. A friend of ours asked one of the most eminent spectroscopists in the country his opinion of it, a few days ago, and he replied that he had nothing to say about it while he had only the newspaper reports of it. The scientific world is waiting for "official" statements on the subject, and we trust it will not have to wait much longer.—*Boston Journal of Chemistry.*

ANTHROPOLOGY.

REPORT ON ANTHROPOLOGICAL SOCIETIES AND INSTRUCTION IN ANTHROPOLOGY

At the International Congress of Anthropological Sciences, at Paris, Aug. 16-18, by Dr. Thulie.

TRANSLATED BY PROFESSOR OTIS F. MASON, FROM REVUE D'ANTHROPOLOGIE.*

The end of the nineteenth century seems to have been appointed to perfect that which was commenced by the great geniuses of the eighteenth, and also to give existence and form to some of their aspirations.

Linnæus, who assigned to man a place in his zoölogical classification, Buffon, who wrote the natural history of man, Blumenbach, who established the divisions of the human race upon craniology, are the fathers of anthropology.

In 1800, a few naturalists and a few physicians founded the "*Societe des observateurs de l'homme.*" This society, following the programme drawn up by Jauffret, its general secretary, proposed principally to direct the researches of travelers. But the wars of the Empire, cutting off all commerce and foreign travel, arrested this endeavor. The society of observers of man abandoned natural history to devote themselves to historic ethnology and to philosophy. After a short while it was invaded by the philhellenists, and became merged, after three years, with the "*Societe philanthropique.*"

In 1838, this effort fell into complete desuetude, when the philanthropists founded at London the "Society for the protection of Aborigines." England

*Expressly for the KANSAS CITY REVIEW.

having abolished slavery, this question began to occupy political circles in France. Hodgkin, one of the most zealous members of the English society, came to Paris to make proselytes, but he could not succeed in persuading the egotistical and complacent society of the reign of Louis Philippe to partake of his aspirations. His mission, however, was not altogether fruitless for science, and William Edwards, by his "*Etude sur les caracteres physiologiques des races humaines considerees dans leur rapports avec l'histoire*," founded, in 1839, the Ethnological Society of Paris.

Since the beginning of the century studies upon man have multiplied, and quite a number of savants have directed their minds toward this interesting, yet neglected portion of natural history. The "*Societe ethnologique*" had its origin under the most favorable conditions. The works of Blumenbach had just appeared, Prichard, Desmoulins, Vizey, Bory de Saint Vincent, Gerdy, D'Orbigny, Brocalet and Lesson had published important memoirs; Morton had brought out his *Crania Americana*; craniological museums were formed; finally, linguistics, that part of anthropology so useful, had just organized into a serious and productive science. When the first volume of "*Memoires de la Societe ethnologique de Paris*" appeared, the learned world were struck with the utility of its labors and researches. An ethnological society was founded in London in 1844, and a short time afterward another in the city of New York, adopting entire the programme of the Paris society.

Flourens, a member of the Ethnological Society and Professor of human anatomy at the museum commenced from that time to set forth in his course of lectures the history of the races of men; Serres, who succeeded him, likewise added as a sub title to his course: "The Anatomy and Natural History of Man." Later, this chair took the name of "*Chaire de Anthropologie*;" it is brilliantly occupied to-day by M. de Quatrefages. It was only in 1865 that a chair of anthropology was founded in Florence; since then three have been established in Germany, and one in Moscow.

Serres founded an anthropological gallery. There had been previously private collections in Germany, Holland, England, and in the United States, but the first public gallery was that of the museum. There are others to-day at Florence, Berlin, Moscow, St. Petersburg, Brussels, Philadelphia, Washington, etc.

It was the "*Societe de Ethnologie*" of Paris which gave to the word anthropology the sense which it bears to-day. But, in truth, the question of slavery absorbed all the activity of the body. The discussion of the distinctive characters of the white and the black race was merely a controversy upon slavery in spite of the efforts of naturalists and physicians, and the society abandoned the purely scientific domain for the passionate discussion of a social question. This was in 1847. In 1848 the society was so given up to this subject that when the Republic abolished slavery, it did not indeed dissolve, but did cease to meet, as if the grand object of its labors had been attained.

Now, the study of man is making rapid progress. In England, Sweden,

Denmark and Switzerland researches and publications are multiplied. In America Samuel Morton brought to bear upon his anthropological researches, geology, palæontology, archæology, general zoölogy, zoölogical geography, and medical geography. He thus prepared the way for that brilliant American school which was broken up by the War of Secession.

But no society yet existed grouping together all the sciences which concur in the natural history of man, from comparative anatomy to the study of customs, from geology to linguistics. It was in 1859 that the "*Societe de Anthropologie de Paris*" was founded. This society has considerably enlarged the former programme of ethnology, in making its appeal to a large number of sciences, by the aid of which it has constituted several new branches, such as general, pre-historic, zoölogic and linguistic anthropology.

Craniology has become purely scientific since this epoch. Enlarging also considerably the ancient programme, and no longer considering ethnological descriptions more than a branch of anthropology, the society has regarded it necessary to take a more general title, that is: "*Societe anthropologique*".

On the first appearance of the Bulletin of the *Societe* its title was adopted abroad. In 1861 a congress of German savants meeting at Göttingen assumed the name of anthropological congress, and at a reunion in 1865 founded the *Archiv fur anthropologie.*

In 1863 "*The Anthropological Society*" was founded at London, declaring itself to be the daughter of the Paris society. It had to maintain a long and animated conflict with the old "Ethnological Society", which desired to remain faithful to the former programme of ethnology, but which wound up by walking in the new path, and thus permitted the fusion of two societies.

Since 1863, anthropological societies have been founded at Manchester, Berlin, Vienna, Florence, Madrid, Havana, etc. A special and very active section under the leadership of Professor Bogdanoff has been constituted in the *Societe imperiale des Amis des Sciences Naturelles*, in Moscow. A special section has also been formed in the Academy of Cracovia.

If all countries which contain distinguished anthropologists have not centers of action and developement, the international Congresses furnish them a bond of union with foreign savants and facilitate their study. It is to Gabriel de Mortillet that we owe the fruitful idea of these Congresses. In the session of the Society of Natural Sciences held at Spezzia in 1865 under the presidency of Professor Capellini, M. de Mortillet proposed to the antehistoric section the foundation of an international palæorthnological Congress. This proposition was adopted, and in 1867 the Congress took the name, "*Congress d'Anthropologie et d' Archeologie prehistorique.*"

I should mention, before closing this very incomplete report, a foundation which dates back no longer than two years, and which has already produced happy results in the diffusion of anthropological science. I speak of the Anthropological Institute of Paris, founded by M. Broca, to whom our science is so much indebted. You may visit the building of this Institute, where are united a museum,

a library, and a laboratory. Owing to the energy of the *Societe anthropologique*, to the activity of our devoted president, to the generous aid of the city of Paris, and of the department of the Seine, we have been able to found the following six courses:

1. Anatomical Anthropology.
2. Biological Anthropology.
3. Ethnic Anthropology.
4. Prehistoric Anthropology.
5. Linguistic Anthropology.
6. Demography and Medical Geography.

It is thus that we hope to expand the knowledge so precious for the future of humanity; it is thus that we wish to know concerning man, what he his, and whence he came, and to be able to predict, without being a prophet, what the new philosophy and scientific sociology will bring out of the labors of anthropologists.

(By an unfortunate oversight, Dr. Thulie has failed to speak of the Wilkes expedition and the Smithsonian Institution, the former of which embraced linguistics in the programme of ethnology, and the latter from its foundation brought within the scope of the study of man all that is now included in the course of lectures of the "*Ecole d' Anthropologie*"—O. T. M.)

THE ORIGIN OF METALLURGY--THE BRONZE AGE.

IV.

We must now speak of the industries of the bronze age, of which the several strata compared with each other have revealed the existence, nature, processes and relative epochs; among them there were some indigenous. Undoubtedly the men of those ancient times must have built their own houses, which were made of wood, after the time they left the caves. Those they erected on solid ground have disappeared without leaving any traces behind; and if the houses of the lakes have been destroyed, at least the piles upon which they were built still remain. Those of the epochs anterior to metal, were nearer the banks and did not project so far out of the water. The others were built beyond the first, and in Savoy, have a greater jutting out, by which they can easily be recognized. The pieces of wood resting on the piles and forming the flooring, were fastened together by means of tenons and mortises; which shows clearly that they could with hatchets and chisels of stone, cut and shape large pieces of wood. Planks were made by splitting the trunks of trees; the stone saws are only several inches long, while those of bronze are not a foot; they could only be used on light work. Of these several specimens have been extracted from the lakes of Savoy, such as spoons, tool handles, spindle shanks, sabots, a porringer, and part of a bucket.

The great number of bobbins of baked clay, which are called by the Italians *fusaioles*, indicate that the custom of spinning and weaving was then extant; there were many discussions as to the use of those small cones bored through their *axis*, but there is now no more doubt, since a complete spindle was found in the

lake of Bourget. We have ourselves seen pieces of wood worn out in the holes of many bobbins, found in Troy by Dr. Schliemann.

These very things are still used throughout the Middle and West of Europe. They could obtain very delicate threads with these spindles of wood and clay, as is evident from the smallness of the eye of several bronze needles. The finest textures have been destroyed under water as well as under ground, but a few specimens of the coarser textures, meshes of nets, thread, cord, and bundles of beaten flax, have been preserved in the mud of the palafittes of Bourget. The flax then used had small leaves, and differed from the kind now cultivated. To the weaving we may add the fabrication of baskets of rushes, reeds and osier, and the making of fishermen's snares, and the large hurdles which were used to fortify the walls of houses in supporting the roof.

The local industry which has left the most traces in the strata of bronze, except the treasures and foundries, is the moulding of argil. We have already noticed that the potteries of the period of stone were not baked, but merely dried in the sun. The art of baking was introduced during the age of polished stone, and continued to be improved during the entire age of bronze. Still the most *ancient* vases of that period were badly baked, very often burnt on one side and raw on the other; it would appear that these potteries were cooked in the open fire and not under a reverberatory furnace, which however was the case. The dishes and plates showed few signs of the fire. It was only toward the end of the bronze age when iron was already beginning to supplant it, that the potter's wheel was used. As simple as was this revolving machine, it afforded certain facilities of fabrication which were formerly unknown. The progress seems to have been made only after the appearance of iron. The various kinds of vases fabricated by processes so elementary were astonishing. Some were used for carrying water, others for preserving and cooking food. There were also some drinking vases, among which are the rhytons, and lamps in imitation of the old Greek and Roman lamps, rings of clay used as rests for small-cased vases and perforated cheese molds as in our own day, which shows that men in olden times were fond of the product of the dairy.

With regard to the ornamentation of pottery, it has received special attention from scientists, for it has afforded, during the bronze age, transformations useful in chronology, which are found on contemporaneous bronzes. The rough pottery of the stone age was ornamented by straight lines engraved thereon with zigzags more or less irregular. In course of time these lines became more regular, and are drawn parallel by means of burins with several points, consequently the figures are more accurately made. The use of concentric rings may be noticed throughout Europe during the bronze epochs. The plain cross, the multiple and four pointed cross, the encircled cross in shape of a wheel, stars and triangles appear regularly in successive years.

The figures are no longer merely engraved with pointed instruments, they are also impressed with stamps of metal, clay or stone. The Swastika (a species of cross with curved arms) and the meandre, which is made up of a succession of

swastika, are to be met with especially during the period of transition from bronze to iron. During the first iron age, and further on in historic times, this figure was popular with the people of the Aryan race, and appeared in the west after the bronze era. It was about this time that the potters began to paint certain vases with red or yellow ochre or with that black which afterward became peculiar to Grecian ceramics. Lastly, the inhabitants of the lacustrial dwellings used a sort of decoration which was, however, afterward abandoned. On the dark bottom of some vases of fine clay, they fastened thin sheets of pewter cut in narrow strips, with rosin, and formed a variety of beautiful designs. Metallic ornamentation, no doubt, had its origin in the West. The industry of bronze characterizes the period now under consideration. In speaking of the foundries we made little mention of the material of the founders; so far there has been found but a small piece of mineral brass, and nowhere in Europe has a furnace or any instrument for extracting ore been found. We may, therefore, be justified in supposing that the metal was brought from the vicinity in its rough state, or already molded. In fact, ingots of bronze are found wherever the founders were stationed, they are in the form of small squares, or like hammers having a hole in the center to hang them up by.

We should recollect that no pure copper* is found, very little tin, whilst throughout Europe bronze is of uniform composition. The following is obtained from the analysis made by Messrs. Wibel and Fellenberg and by M. Damour; the proportion of tin is about ten per cent., but there are exceptions as in cold chisels and one or two other objects of hard bronze, which contain as much as a quarter of tin to three-quarters copper. This uniformity of composition of alloy throughout Europe, proves the unity of its origin and importation, but of this further on.

Researches have brought to light besides ingots and refuse castings of metal, a number of molds made of schist, steaschist, freestone, baked clay and bronze. Many of these have figures on two or four sides, and on some there are several figures along side of each other. The crucibles are made of earth mixed with broken quartz and often contain metal. Some have the shape of the laboratory crucible, while others are like cups with handles. All these receptacles could contain but a small quantity of metal; their form and dimensions are pretty much the same throughout Europe.

The articles, made by means so rudimentary, may be divided into three classes, viz., tools and utensils, arms and ornaments. Among the first may be included the hatchets first made similar to stone hatchets, with holes for the purpose of inserting a handle which was fastened in the socket with a cord. We are able, considering the superposition of the layers in the lacustrial habitations and stations to follow these transformations, and determine their relative epochs. Scissors, knives, chisels, sickles, handles, saws, gimlets, jewelers' pincers, are the tools usually found in all the strata. We may also add razors, which were first made of hard stone, then of bronze, which were finally supplanted by iron ones.

* It appears that in Hungary and Greece many specimens have been noted.

These instruments were not of the shape which they are to-day; they were semi-circular with the edge on the side of the curve. Then there were some double ones edged on both sides of their diameter, and fastened to an ornamented handle, forming together but one piece. The different razors will enable us to ascertain the relative age of the strata in which they are found.

Was the horse domesticated at the appearance of bronze? It is probable that he was tamed during the period of polished stone, and yet it is possible he may have been long before. If he was then only in a wild state, it would be difficult to explain the quantity of bones which are found in certain places of the first period of stone, as in Polutré. This station, which is not far from the Saone river, above Macon, contains, it is said, the skeletons of 100,000 horses, most of them young, which may have served as food for the inhabitants of the place.

Be it as it may, the bronze bits found among the piles of the lake of Briene and afterward in France, bear witness to the fact that the horse was already subdued. The oldest of these bits are made of two movable pieces one above the other in center of the animal's mouth. Soon after the four pieces are movable, although each of the exterior pieces has a cross-piece through the middle, and thus forming two equal branches. This second class of bit characterizes the terramares, and had been learnedly studied by Count Gozzadina. It seems that in the stone age the horse half tamed was used as food for man, that being subdued in the second period he was mounted and perhaps harnessed, and, finally, at least in Italy, at the end of the bronze age he became tame enough to be guided about with a string. Arms do not form the least interesting portion of our bronze collection; they perhaps better than anything else enable us to determine the successive phases of this metal. They are found everywhere in Europe and Asia, but they should not be attributed to Gaul as has been done. The palafittes, foundries and treasures have given them their definitive place in the bronze age, and if they appear only in small quantities, owing to the scarcity of the metal, they soon become so abundant as to supplant entirely the arms of stone. Later on iron is found in many places in Europe, but in small quantities and is regarded as an object of luxury. It soon after exercises in its turn an appreciable influence on bronze arms, the form and size of which are modified. Finally, bronze is entirely abandoned. The blade of the swords and poignards of the early part of the bronze age was of metal, but not the handles. Often in these primitive arms, the tongue of the blade does not go far into the handle; it is broad, short and pierced with two or more holes through which the iron rivets pass. Afterward metal handles are made, either without a guard or one in the shape of a cross. Switzerland, Denmark and Sweden have produced swords with antennæ, that is to say, with two prongs jutting out and curved at the end of the handle above the hand. The long swords, the length of which is often two feet and a half, which are to be found throughout the West, had handles made of horn, wood and bone, and resembled the iron sword which soon replaced them. In France there have been discovered 650 swords and poignards of bronze, in Switzerland 86; in Sweden 480, and they are generally found throughout Europe.

The dolmens and sepulchral caves of Lauguedoc and Vivarais, the palafittes of the lakes of Neufchatel and Varesa, have produced arrow heads similar to those of silex which had preceded them, and used up to the transition from stone to metal; they characterize this epoch as the razor characterizes the transition of bronze to iron. These small pieces of metal were flat, being fastened in the shaft with a cord.

It is during the second period of the bronze age that armor is made of metal, as helmets, shields and cuirasses; prior to this time they are made of leather and wood. This is the period that M. de Mortillet designated by the term "Chandronnerie," the art of enlarging and shaping iron under the hammer being added to that of molding. This method was used not only in the manufacture of armory, but also to the edging of arms and tools and of a multitude of ornamental objects.

The latter outnumbered the former, especially when metal was rare; pins are picked up by hundreds. The foundry of Larnaud has furnished 214 bracelets, the lake of Bourget more than 600, and a great number have been found in the dolmens of Central Europe. The oldest are oval, the latest round; those which date from the bronze epoch are open, but are closed as soon as the industry of iron is general. The large collar rings, called torques by the Romans, are not found until after the appearance of the latter metal; finger rings are scarce throughout Europe, but plain rings, necklaces and buckles are everywhere found in large quantities; there are besides these many other ornaments or amulets, such as earrings, fillets, &c., which evidently have a symbolic character. Let us here note that these symbolic figures are about the only signs of any religion during the bronze epoch. We may add that they are not indigenous, but are doubtless derived from Asia, as also the cithern which is made of hollow reeds with nine or twelve rings fastened at the end of a stalk of wood. There are several in existence, two of which were found in France, three in the lake of Bourget, the others at Christiana, at Wladimir and Yavorlan. These citherns are not like those of Egypt, but like those of the priests of Buddha, who themselves hold them of an ancient Aryan tradition.—*Van Nostrand's Magazine.*

In answer to a request of Dr. Fischer, Mr. W. H. Holmes, the distinguished artist of the Hayden Survey, sends us the following note:

"The most extensive deposits of obsidian yet known in this country were found last summer in the Yellowstone Park. Arrow points and flakes of obsidian had previously been collected in the various valleys about the sources of the Missouri and Snake rivers, but the source of supply was unknown. Near the head of the middle fork of Gardiner's River, in the northwestern part of the Park, deposits of this rock nearly 600 feet in thickness and of unknown horizontal extent were found. In making examinations of the strata at this point I noticed the occurrence of great numbers of flakes of obsidian. These are most plentiful along an old Indian trail, and after a careful search nearly a dozen more or less perfect implements were obtained."—*Harper's Monthly.*

GEOLOGY.

PROF. J. D. DANA'S TABLE OF GEOLOGICAL FORMATIONS. 1878.

Systems of Ages.		Groups of Periods.	Formation of Epochs.
Age of Man.		20 Quaternary.	20. Quaternary.
Age of Mammals.		19 Tertiary.	19c. Pliocene. 19b. Miocene. 19a. Eocene.
Reptilian Age.		18 Cretaceous.	18c. Upper Cretaceous. 18b. Middle Cretaceous. 18a. Lower Cretaceous.
		17 Jurassic.	17. Jurassic.
		16 Triassic.	16. Triassic.
Carboniferous.		15 Permian.	15. Permian.
		14 Carboniferous.	14c. Upper Coal Measures. 14b. Lower " " 14a. Millstone Grit.
		13 Subcarboniferous.	13b. Upper Subcarboniferous. 13a. Lower "
Devonian or Age of Fishes.		12 Catskill.	12 Catskill.
		11 Chemung.	11b. Chemung. 11a. Portage.
		10 Hamilton.	10c. Genesee. 10b. Hamilton. 10a. Marcellus.
		9 Corniferous.	9c. Corniferous. 9b. Schoharie. 9a. Canda Galli.
Silurian or Age of Invertebrates.	Upper Silurian.	8 Oriskany.	8. Oriskany.
		7 Lower Helderberg.	7. Lower Helderberg.
		6 Salina.	6. Salina.
		5 Niagara.	5c. Niagara. 5b. Clinton. 5a. Medina.
	Lower Silurian.	4 Trenton.	4c. Cincinnati. 4b. Utica. 4a. Trenton.
		3 Canadian.	3c. Chazy. 3b. Quebec. 3a. Calciferous.
		2 Primordial or Cambrian.	2b. Pottsdam. 2a. Acadian.
		1 Archæan.	1b. Huronian. 1a. Laurentian.

TABLE OF THE GEOLOGICAL FORMATIONS, ARRANGED FOR MAC FARLANE'S GEOLOGICAL RAILWAY GUIDE.

BY PROF. T. STERRY HUNT, LL. D., F. R. S.

AGES.	GROUPS.	AMERICAN FORMATIONS.
Cenozoic.	20. Quaternary.	20. Recent.
	19. Tertiary.	19c. Pliocene. 19b. Miocene. 19a. Eocene.
Mesozoic.	18. Cretaceous. 17. Jurassic. 16. Triassic.	18. Cretaceous. 17. New Red Sandstone. 16. " " "
Paleozoic.	15. 14. Carboniferous. 13.	15. Permo-Carboniferous. 14. Coal Measures. 13b. Mississippi (carb. Limestone). 13a. Waverly or Bonaventure.
	8–12. Erian or Devonian.	12. Catskill. 11. Chemung and Portage. 10. Hamilton, including Genesee and Marcellus. 9. Corniferous or Upper Helderberg. 8. Oriskany.
	5–7. Silurian.	7. Lower Helderberg. 6. Onondaga or Salina. 5c. Niagara including Guelph. 5b. Clinton. 5a. Medina. 5a. Oneida.
	4. Upper Cambrian or Siluro-Cambrian.	4c. Loraine. 4b. Utica. 4a. Trenton.
	3. Middle Cambrian.	3c. Chazy. 3b. Levis, (Tremadoc and Areing). 3a. Calciferous,
	2. Lower Cambrian.	2d. Potsdam. 2c. Sillery. 2b. Acadian, (Menevian). 2a. Lower Taconic.
Eozoic.	1. Primary or Crystalline.	1d. Montalban. 1c. Norian or Labrador. 1b. Huronian. 1a. Laurentian.

REMARKS ON HUNT'S AND DANA'S SECTIONS.

BY PROFESSOR G. C. BROADHEAD, PLEASANT HILL, MISSOURI.

Critically comparing these geological sections, pages 664-5 in some respects we find both are good. We like Dana's term Archæan better than Azoic or Eozoic. Newberry and Hitchcock, with Hunt, have adopted the term Eozoic. Archæan signifies ancient, Eozoic the period of the first dawn of life. There may be a previous life period but as yet unknown, and for this reason therefore it has been well to discard the term Azoic, for it did not convey the full truth. Neither do we entirely like the term "Primary" for it may not include the oldest. But this is not so important. The term "Taconic" used first by Emmons, and since by Hunt, is not adopted by many Geologists, for of the exact or proper position of these rocks there yet remains doubt.

Mr. MacFarlane divides the Quebec into the lowest, (1) Sillery next (2) Levis and (3) Lauzon and all above the Potsdam. Dr Hunt places the Sillery below the Potsdam. Dana (1874) quotes Sir William Logan who separated the Lauzon from the upper part of the Levis. He also added the Sillery sandstone found near Quebec and supposed it to rest above these; but the section was afterward found to be inverted and the Sillery to be below, still the exact Geological position of the Sillery has not been settled by the Canadian Geologists.

Dr. Hunt used the term "Cambrian" in a more extensive relation than Dana and some other geologists. In this he follows Sedgwick the English geologist who first used the term, applying it to all those formations between the Archæan and upper Silurian. Hunt only terms the latter "Silurian." In his Geological essays he treats of these formations in detail. He claims that Sedgwick fully described them and applied the term Cambrian before Sir R. Murchison enunciated his Silurian system, that a great wrong was done him by Murchison, who suppressed his names and used instead the term "Silurian" and that Silurian is only corretly applied to the upper Silurian. Opposed to this we find the English Geologists have since adhered to Murchison's nomenclature although the priority of the name Cambrian may be due to Sedgwick, Hunt, Shaler and a few others have adopted and use the term Cambrian in their descriptions of American Geology, but Dana, Newbery, Hall, Hayden, Safford, Selwyn and most of the American Geologists use the term Silurian as adopted by Murchison. As used by Dana it has become a household name in American Geology and as all students understand his nomenclature, we see no good reason for a change, even though a long time since, an act of injustice may have been done to Sedgwick in a mere name.

To the Devonian Dr. Hunt also applies the general term Erian. In America this may be a good name, as rocks of this age are well developed near Lake Erie.

In this connection we notice an important paper by Dr. J. S. Newberry read before the National Academy of Science, and published in *Science News*, Salem, Massachusetts, December 1st, 1878.

The most important difference is where Dana places the Oriskany at top of the upper Silurian. Hunt puts the Oriskany at the base of the Devonian. In this he is supported by Newberry, Hall, Vernuil and Lyell. Dr. Newberry says that between the Helderberg and Oriskany there is as strongly marked physical break as is found in the Series, and in Ohio the two formations are distinctly unconformable, and that in Canada the most characteristic fossils of the Oriskany, *Spirifer arenosus* and *Rensselaeria ovoides*, are mingled with Corniferous species.

Observations of Geologists in Brazil also go to show that the Oriskany should be placed in the Devonian.

Dr. Newberry says that the carboniferous really begins with the Portage and includes the Chemung and Catskill. The Portage Sandstones show ripple marks and sun cracks indicative of exposure to the air, and the same evidence existing in the Chemung in Pennsylvania, also shows that a subsidence was in progress. This subsidence culminated in the spread of the carboniferous sea and deposits in the valley of the Mississippi of carboniferous limestones in the deeper seas. The fossils tell the same story as those of the Chemung and are more Carboniferous than Devonian.

Another point to which Dr. Newberry refers is the disputed age of the Lignitic or Laramie group of Colorado. Professor Lesquereux our ablest Palæo-botanist places this group among the Tertiary, based on a careful study of its extensive flora. In this view he has been supported by Professor Hayden. All of our other Geologists and Palæontologists assign it to the age of the Cretaceous. They base their reasons on a study of the fauna—Cope and others on the Vertebrata. On a recent map of Hayden, it is marked Post-cretaceous. Dr. Newberry after the most careful study of the plants and also of all that had been written on the subject, said he failed to find satisfactory evidence of the Tertiary character of the flora. He also states the unconformability of the Laramie group with the coryphodon beds, the recognized base of the Eocene.

Dr. Newberry also claims while the term Hudson River group was, as stated by Professor Hall, just and convenient as applied to New York rocks, the Cincinnati series was not its equivalent, for it represented the whole maps of the Trenton group as well as the Hudson River and that the fossils of both formations were confusedly mingled at Cincinnati; that there were no lithological divisions of the series and that necessarily we must retain the term Cincinnati group as a local designation of a great series of lower Silurian rocks.

Prof. W. B. Rogers, in his section of Virginia rocks revised for MacFarlane's Directory, uses the terms Archæan, Middle and Lower Cambrian. Situn Cambrian or Upper Cambrian, Silurian, Devonian, Carboniferous, etc. He also puts the Oriskany at the top of the Silurian.

The exact relations of the beds on the Hudson River, New York, known as the Hudson River group, have been by some geologists misinterpreted, and the group as there exposed has been placed with some beds much older. But Prof. Hall recognized the importance of the distinct group, as Hudson River, in 1841, 1843, 1850 and 1858. The Canadian geologists at one time regarded these rocks as of the age of the Levis, and Prof. Hall in 1861 provisionally dropped the

term Hudson River, but his later observations have convinced him of the propriety of restoring it. In a paper read before the Nashville meeting of the American Association, August, 1877, he says: "Limited on the east by older rocks, the formation extends in unbroken continuity from the Hudson through the Mohawk valley, out-cropping on one or both sides of the river, expanding over a wide area in Oneida, Lewis, Oswego and Jefferson counties. Here interrupted by Lake Ontario, its extension may be taken up on the north shore of the lake and traced throughout the upper Peninsula. Thence upon the islands of Lake Huron, becoming more agillaceous and calcareous in its western extension, everywhere resting on the Trenton limestone and surmounted by the Medina, Clinton and Niagara groups. The formation everywhere contains the same species of fossils, with a largely increasing number of individuals and of species as we go westward. The forms known in the Hudson and Mohawk valleys are found at Toronto, in the islands of Lake Huron, Green Bay and elsewhere."

Prof. Mather, in his early geological reports of New York, traced the formation of the Hudson valley along the Mohawk. His arguments in favor of the term Hudson River group were accepted, and the name adopted.

Prof. Hall also considers the Cincinnati rocks as of the same age as the rocks between the Trenton below and Clinton or Niagara above. Certain older rocks near the Hudson River in their altered conditions were not readily assigned to their proper position by some geologists, and the true Hudson River group was placed with them, hence the confusion. In the *American Journal of Science* for January, 1879, Mr. T. Nelson Dale, Jr., mentions the finding of well-known Hudson River group fossils at Poughkeepsie, thus identifying the formation.

At a meeting of the Cincinnati Society of Natural History, held on the 23d day of January, 1879, a committee was appointed to consider the proper nomenclature of the Cincinnati rocks. Their report asserts that the lowest rocks at Cincinnati contain a fauna typical of the Utica slate for fifty feet from low water mark in the river. A little higher, the fossils as well as the position of the rocks indicate the age of the Hudson River group. Also that the fossils from Paris, L xington and Highbridge, over the Kentucky River, as well as the lithological character of the strata, furnish abundant evidence of the existence of the Trenton group over an extensive tract of country in Kentucky. In the State of Kentucky we have the Trenton, Utica and Hudson River groups well represented, and the rocks have a northerly dip from Paris and Lexington toward the Ohio River. In Southeast Indiana the Lower Silurian rocks are referred to the Hudson River group. The Trenton is not represented in Ohio on the Ohio River as far as known, and the Utica is only represented in the banks of the river at Cincinnati; and all the other Lower Silurian rocks in Southwestern Ohio may be referred to the age of the Hudson River group.

The committee further recommend to drop the name of the Cincinnati group because it is a synonym, and its retention can subserve no useful purpose, and to retain the well-known names adopted by the New York geologists.

The report is signed by S. A. Miller, A. G. Weatherby, Paul Mohr, C. B. Dyer, R. M. Byrnes, and othe s.

MOUNTAIN MAKING—HOW THE ALPS WERE FORMED—A GEOLOGICAL THEORY.

Professor Judd, of the Royal School of Mines, London, gave recently an interesting explanation of the formation of the Swiss Alps. The results of geological observations, he said, show that four stages can be recognized in the history of these Alps. First, the exist nce of a line of weakness in the earth's crust nearly coincident with the line of the present mountains. This is evidenced by the fact that along this line of weakness there were volcanic outbursts, the result of which can still be traced. Secondly, there followed along this line of weakness a depression, and in this huge "trough," of miles in extent, there accumulated sands, lime-stones, and clays by various forms of water agencies, and by animals living in the waters. Thirdly, there followed the consolidation of these soft and loose materials. There is evidence that the accumulation was of from six to seven miles in thickness, and the mere weight of the superincumbent material on the lower strata would have a share in effecting consolidation. But this was not all. Under this vast covering heat had led to crystallization from fusion. There was, too, the crushing in from the sides of the trough. This was illustrated by a model of the late Sir H. de la Beche, where lateral pressure was employed on layers of different-colored cloth, showing how crumpling resulted, with uplifting of parts of the accumulated mass. Fourthly, there had been the sculpturing of all this into its present form, which was the work of rains and frosts. Some of the existing peaks, even 3000 feet high, were composed entirely of the disintegrated material resulting from the action of the water, either as ice in glaciers or as rain and streams. The amount of material removed in this way was so stupendous that it was almost staggering to try to grasp the facts. The sculpturing of the contours is still going on. This fourth stage was of quite recent date, speaking geologically; but the whole history involved a lapse of time which at the beginning of this century philosophers would not have been prepared to grant, even if the since-acquired knowledge of facts had been presented to them.

—*Engineering and Mining Journal.*

PHYSICS AND METEOROLOGY.

ON SOME PHYSICAL PROPERTIES OF ICE; ON THE TRANSPOSITION OF BOULDERS FROM BELOW TO ABOVE THE ICE; AND ON MAMMOTH REMAINS.

BY JOHN RAE, M.D., LL. D., F. R. G. S., ETC. GOLD MEDALIST OF GEOGRAPHICAL SOCIETY.*

Is the ice formed on salt water fresh? or, in other words, if ice formed on the sea is thawed, will the water obtained thereby be fresh?

For a number of years past I have spoken with many persons on the subject;

* Read befo e the Physical Society, May 9, 1874.

and seldom, if ever, have I found a single individual who did not say that the ice of the sea was fresh.

Some of these gentlemen are known in the scientific world; and many of them supported their opinions by quoting the highest written authorities on the subject, chiefly Tyndall's "Forms of Water," p. 132, par. 339, which tells us that "even when water is saturated with salt, the crystallizing force studiously rejects the salt, and devotes itself to the congelation of the water alone. *Hence the ice of sea-water, when melted, produces fresh water.*"

It is the sentence in italics to which I wish to draw particular attention.

It would be the extreme of folly and presumption on my part to question the correctness of results obtained by scientific men in their experiments in freezing small quantities of sea-water by artificial means, more especially those of the disguished gentleman whose name I have mentioned, who, in addition to holding the high position of being one of our greatest authorities in all that relates to physical science, possesses the rare g ft of being able to communicate his knowledge in such plain, clear, and forcible language, illustrated by admirable experiments, as to make his meaning fully understood, even by those who had previously been perfectly ignorant of the subject.

It is only where I have had opportunities of witnessing the action of cold carried on in a manner which may have been denied to the scientific man, that I venture to differ from him; and it is in this way that the conviction has been forced upon me, that the ice of sea-water if melted *does not* produce fresh water.

Before entering upon this subject, however, let me say a word or two on the first part of the quotation I have given.

If a saturated solution of salt is frozen, and the ice so formed is fresh, it is evident that the salt that has been "rejected" must be deposited or precipitated in a crystalline or some other solid form, because the water, if any, that remains unfrozen, being already saturated, can hold in solution no more salt than it already contains.

Could not salt be obtained readily and cheaply by this means from sea-water in cold climates?

During several long journeys on the Arctic coast, in the early spring before any thaw had taken place, the only water to be obtained was by melting snow or ice. By experience I found that a kettleful of water could be obtained by thawing ice with a much less expenditure of fuel, and in a shorter time, than was required to obtain a similar quantity of water by thawing snow, Now, as we had to carry our fuel with us, this saving of fuel and of time was an important consideration, and we always endeavored to get the ice for this purpose. We had another inducement to test the sea-ice frequently as to its freshness or the reverse.

I presume that almost every one knows that to eat snow when it is very cold, tends to increase thirst, whereas a piece of ice in the mouth is refreshing and beneficial, however cold it may be; we were consequently always glad to get a bit of fresh ice whilst at the laborious work of hauling our heavy sledges; yet

with these strong inducements we were never able to find sea-ice, *in situ**, either eatable when solid or drinkable when thawed; it being invariably much too salt. The only exception (if it may be called one) to this rule, was when we found rough ice, which, from its wasted appearance and irregular form, had evidently been the formation of a previous winter. This old ice, if projecting a foot or two above the water-level, was almost invariably fresh, and, when thawed, gave excellent drinking-water. It may be said that these pieces of fresh ice were fragments of glaciers or icebergs; but this could not be so, as they were found where neither glaciers nor icebergs are ever seen.

How is this to be accounted for? Unfortunately I have only a theory to offer in explanation.

When the sea freezes by the abstraction of heat from its surface, I do not think that the saline matter, although retained in and incorporated with the ice, assumes the solid state, unless the cold is very intense, but that it remains fluid in the form of a very strong brine inclosed in very minute cells. So long as the ice continues to float at the same level, or nearly the same level, as the sea, this brine remains; but when the ice is raised a little above the water-level, the brine, by its greater specific gravity, and probably by some solvent quality acting on the ice, gradually drains off from the ice so raised; and the small cells, by connecting one with another downward, become channels of drainage.

There may be several other requisites for this change of salt ice into fresh, such as temperature raised to the freezing-point, so as to enable the brine to *work out* the cell-walls into channels or tubes—that is, if my theory has any foundation in fact, which may be easily tested by any expedition passing one or more winters on the Arctic, or by any one living where ice of considerable thickness is formed on the sea, such as some parts of Norway.

All that is required, as soon as the winter has advanced far enough for the purpose, is to cut out a block of sea-ice (taking care not to be near the outflow of any fresh-water stream) about 3 feet square, remove it from the sea to some convenient position, test its saltness at the time, and at intervals repeat the testing both on its upper and lower surfaces, and observe the drainage if any.

The result of the above experiment, even if continued for a long while, *may* not be satisfactory, because the fresh ice that I have described must have been formed at least twelve months, perhaps eighteen months, before.

THE TRANSPOSITION OF BOULDERS FROM BELOW TO ABOVE THE ICE.

When boulders, small stones, sand gravel, etc. are found lying on sea-ice, it is very generally supposed that they must have rolled down a steep place or fallen from a cliff, or been deposited by a flow of water from a river or other source. There is, however, another way in which boulders etc. get upon floe-ice, which I have not seen mentioned in any book on the subject.

During the spring of 1847, at Repulse Bay on the Arctic shores of America,

* What I mean by ice *in situ* is ice lying flat and unbroken on the sea, as found during the winter it is formed in.

I was surprised to observe, after the thaw commenced, that large boulders (some of them 3 or 4 feet in diameter) began to appear on the surface of the ice; and after a while, about the month of July, they were wholly exposed, whilst the ice below them was strong, firm, and something like 4 feet thick.*

On the shores of Repulse Bay the rise and fall of the tide is 6 or 8 feet, sometimes more. When the ice is forming in early winter, it rests, when the tide is out, on any boulders etc. that may be at or near low water mark. At first, whilst the ice is weak, the boulders break through it; but when the ice becomes (say 2 or 3 feet) thick, it freezes firmly to the boulder, and when the tide rises, is strong enough to lift the boulder with it. Thus, once fastened to the ice, the stone continues to rise and fall with the rise and fall of each tide, until, as the winter advances, it becomes completely inclosed in the ice, which by measurement I found to attain a thickness of more than 8 feet.

Small stones, gravel, sand, and shells may be fixed in the ice in the same way.

In the spring, by the double effect of thaw and evaporation, the upper surface of the ice, to the extent of 3 feet or more, is removed, and thus the boulders, which in autumn were lying at the bottom of the sea, are now on the ice, while it is still strong and thick enough to travel with its load, before favorable winds and currents, to a great distance.

The finding small stones and gravel on ice out at sea does not always prove that such ice has been near the shore at some time or other.

I have noticed that wherever the Walrus in any numbers have been for some time lying either on ice or rocks, a not inconsiderable quantity of gravel has been deposited, apparently a portion of the excreta of that animal, having probably been taken up from the bottom of the sea and swallowed along with their food.

MAMMOTH REMAINS—THE POSITION IN WHICH THEIR SKELETONS ARE FOUND, ETC.

In Lyell's "Principles of Geology," vol. i., p. 185, we read: "In the flat country near the mouth of the Yenesei River, Siberia, between latitudes 70° and 75° north, many skeletons of mammoths, retaining the hair and skin, have been found. The heads of most of these are said to have been turned to the south."

As far as I can find, the distinguished geologist gives no reason why the heads of the mammoths were turned to the south; nor does he say all that I think might be said of the reasons why, and the means by which the skins have been preserved for such a long period of time.

Having lived some years on the banks of two of the great rivers of America, near to where they enter Hudson's Bay, and also on the M'Kenzie, which flows into the Arctic Sea, I have had opportunities of observing what takes place on these streams, all of which have large alluvial deposits, forming flats and shallows, at their mouths.

*There were no cliffs or steep banks near, from which these boulders could have come, and the only way in which I could account for their appearance, was that which by subsequent observation I found to be correct.

What I know to be of common occurrence in these rivers may, if we reason by analogy, have taken place in ancient times on the great rivers of Siberia, making due allowance for the much higher northern latitude to which these streams run before reaching the sea, and for the difference in size of the fauna that used to frequent their banks.

When animals, more especially those having horns, tusks, or otherwise heavily-weighted heads, are drifting down a river, the position of the bodies may lie in any direction as regards the course of the stream, as long as they are in water deep enough to float them; but the moment they get into a shallow place, the head, which sinks deepest (or, as sailors say, "draws most water"), takes the ground, whilst the body, still remaining afloat, swings to the current, just as a boat or ship does when brought to anchor in a tideway.

It is probable that the mammoths, having been drowned by breaking through the ice or in swimming across the river in spring when the banks were lined with high, precipitous drifts of snow, which prevented them from getting out of the water, or killed in some other way, floated down stream, perhaps for hundreds of miles, until they reached the shallows at the mouth, where the heads, loaded with a great weight of bone and tusks would get aground in three or four feet of water, whilst the bodies still afloat would swing round with the current as already described.

The Yenesei flows from south to north, so the heads, being pointed up stream, would be to the south.*

Supposing, then, these bodies anchored as above in three or four feet of water; as soon as the winter set in, they would be frozen up in this position. The ice in so high a latitude as 70° or 75° north would acquire a thickness of five or six feet at least, so that it would freeze to the bottom on the shallows where the mammoths were anchored. In the spring, on the breaking up of the ice, this ice being solidly frozen to the muddy bottom, would not rise to the surface, but remain fixed, with its contained animal remains, and the flooded stream would rush over both, leaving a covering of mud as the water subsided.

Part of this fixed ice, but not the whole, might be thawed away during summer; and (possibly, but not necessarily) next winter a fresh layer of ice with a fresh supply of animal remains might be formed over the former stratum; and so the peculiar position and perfect state of preservation of this immense collection of extinct animals may be accounted for without having recourse to the somewhat improbable theory that a very great and sudden change had taken place in the climate of that region.

I have seen at the mouth of Hayes River in America animals frozen up as above described; but as the latitude of this place is only 57° north, the fixed ice

*Not many years ago, when buffalo were very abundant on the Saskatchewan, hundreds of them were sometimes drowned in one season whilst swimming across the river; and many reindeer, moose, and other animals are annually destroyed in this way in other large American rivers.

Sir Charles Lyell mentions a number of yaks being seen frozen up in one of the Siberian rivers, which, on the breaking up of the ice in spring, would be liberated and float down the stream.

usually wholly disappears before the next winter sets in, and liberates the animals shut up in it; but when the rivers reach the sea, as some of those of Siberia do, 1,000 or 1,200 miles further to the north, it may be fairly assumed that a large part of this fixed ice, protected as it would be by a layer of mud, might continue unthawed.

Addenda.—It is not difficult to account for the remains of mammoths being found in a fresh state in the ice-cliffs on the banks of the great Siberian Rivers. On these rivers (especially far north) the immense pressure of the water in shoving, forces the ice in great heaps on to the shore, and with the ice any dead animal, which would be preserved for any length of time whilst the ice-cliff remained entire.

A PLAN FOR ESTABLISHING LIFE-SAVING AND SIGNAL STATIONS IN MID-OCEAN.

ISAAC P. NOYES, WASHINGTON, D. C.

As navigation increases between the old and new world, the necessity for life-saving stations in mid-ocean is more and more felt every year.

This has undoubtedly been a subject that in some way or other has presented itself to many minds—to some as only a passing thought, as quickly away as it came; to others a thought chiefly in connection with its seeming impracticability, while to a few it has been much dwelt upon, in hopes of solving it in some way or other that would be of practical value to mankind—either for the saving of life or for the interest of science. Had this problem, in all its various details, been easy to solve, so as to have become a practical reality, something ere this would have been done toward accomplishing it.

Of course the great impediment in the way is the enormous depth of water, making it, under any present known system, simply absurd to entertain thoughts of locating anything in the shape of a vessel or buoy that must necessarily require such an extensive cable in order to secure it in its place. There would be no trouble about the anchorage, or the vessel or buoy, in what was at the bottom or at the top, but simply in the connecting link between the two. "Simply" in this case though, like in many others, is the chief and almost impossible thing—that is seemingly impossible up to this date. As we read the history of the world we see that safety guards and institutions for the interest of science are more and more established as the world progresses, and what at one age would not have been demanded or even hardly thought of, in another is looked upon as an indispensable necessity. What is considered as impracticable in one age, in another or future age is smiled at and done apparently without the least possible effort, as though it was the most easy and natural thing imaginable.

Such a subject may prompt the question, Is it desirable even if practical? and perhaps many may scout the practicability of such an idea. When we read

of some fearful accident or wreck at sea, where some noble ship containing hundreds of precious lives has gone down with all on board, or only a few left to tell the mournful tale, this question of life-saving stations far out away from land has presented itself in a very forcible manner, and the mind seems impatient and would leap at once to the rescue to prevent or lessen the fearfulness of such catastrophes. But no sooner is this thought through the brain than "How?" presents itself. How overcome this huge difficulty in the way? how make this *connecting link*, the cable, that shall secure the vessel or buoy to the anchorage at the bottom? After a number of years' thought on this subject a suggestion finally occurred to me whereby, I think, this connecting link may be made a practical thing, and no longer be in the way of the consummation of this auxiliary to the safety of ocean travel, and the means of taking regular mid-ocean observations the same as on land. For the cable proper I would not have anything unlike cables in general, yet would suggest a galvanized iron wire cable similar to those used on large derricks, in place of the regular chain as employed by vessels for anchoring; as on the whole I think it would be stronger. But then the matter of the kind of cable in this connection just now is not of much importance, the principal point being now how to construct and lay it so that it will be a practical thing.

Some parties who have thought on this question have sugges ed the anchoring of an immense buoy, and making of this a huge store-ship, &c. In this place I would remark that I think that a buoy properly shaped and constructed would be better than a vessel, for the reason that the upper portion of the cable could be so arranged as not to interfere with passing vessels. Experts say that the trouble with the buoy and cable would be two-fold: First, the great length of chain would require it to increase very fast in size as its distance increased from the bottom in order simply to have sufficient strength to hold itself up. Second, this great weight would necessitate a buoy or vessel of such huge proportions as to make the thing as a whole simply impracticable in the way of cost, etc.

Sometimes it may be best to have the strength of a thing concentrated in one support or bearing, but in general the more we divide it up the better, and this would seem to be the idea to follow out in this cable or connecting link.

There would be no trouble in constructing a number of small buoys. So in the place of one huge buoy, which experts say would have be so large, I would have a number of smaller ones, and these I would have at intervals of about two hundred and fifty feet, or thereabout. But the exact measurement of these intervals is of very little consequence at present; they may be more or less, and could easily be determined upon whenever it was proposed to carry the idea into effect, and would depend upon the size of the buoy, weight of cable adopted, etc.

This length, two hundred and fifty feet, is simply taken in order to illustrate the plan with a little more facility, as most people can understand such things by illustration better than by abstract or technical terms. The depth of the Atlantic Ocean where such anchorages would be required is from 10,000 to 15,000 feet. At 250 feet for a section, this would make from twenty to thirty sections, requiring twenty to thirty buoys. If each buoy had sufficient bearing capacity to support

its section of cable, it will readily be seen that the cable will stand as to strength on the same relative proportion and basis as any ordinary cable of 250 feet; so that if the anchor was in water three miles deep, the strength of chain or cable would be intact for the purpose of holding the vessel or buoy at the surface, as though at any ordinary anchorage.

Many may ask how are we to get these buoys all strung, as it were, on this cable, into position. This, at first, seemed as unsurmountable as the cable itself, but now it seems the easiest thing imaginable; and, in fact, not more difficult than it would be to effect any deep anchorage. Let the cable be constructed with the buoys all attached at their regular intervals, and in this manner towed to their respective grounds; soundings of which should be taken in advance, in order to determine the necessary length of cable, allowance to be made for the angle at which the cable would lie in the water. When this has been accomplished, secure the anchor and let-go, and like any other anchor there would be no trouble in its finding its way to the bottom and taking hold.

When located, these buoys or stations should be manned much after the manner of light-ships and life-saving stations, combined with lights, signals, stores and life-saving implements; and in addition to this have regular signal officers stationed upon them, with established communications with the head-quarters on shore via the ocean telegraph. Then we could begin to trace storms upon the ocean as well as upon the land, and if for no other purpose it would seem that these stations would pay for themselves.

After having constructed the stations and suggested what could be accomplished by them, the practical mind will certainly ask how will we pay for them. Even if good, there must be a great many of them in order to have them of any practical value. I propose to follow up the same idea as in regard to the construction—divide up the cost between the nations. All the civilized people of the world are interested in the safety of the travel between the old world and the new, and it would seem should likewise be interested in the attempt to trace the line of a storm on the ocean as well as on the land, for only thereby can we become as familiar as we should be with the weather of the whole globe.

The great powers, like the United States, England, France, Germany, Russia, etc., should each construct and maintain a certain proportion, and the smaller and more distant powers like Holland, Italy, Turkey, etc., a smaller proportion each. In order to stretch across the ocean between America and Europe, a contribution of two from each of the larger powers and one from each of the smaller powers would locate them within the comparatively short distance of 150 to 200 miles of each other. We cannot locate ocean accidents or tell just where storms may happen, and then place our buoys or vessels, neither is there an attempt to do this in our life-saving and weather stations on land. That would be simply impossible. It is not proposed either at present to be able to get them close enough to be in the neighborhood of every accident or on the line of every storm, yet if placed at these intervals I think that they would pay for themselves in the good they would secure to humanity. We read of mighty works done in

the past, but when we come to look at them carefully we find them executed by unwilling hands—a serf class—all for the mere vanity of those in power, and not for any real good to mankind. Somehow or other the world has always spoken of the present age in a mere hard mechanical way. We have the Stone, Brass, Iron Age, etc., though occasionally we have the more intellectual designation of "Age of Reason," yet I think there is another name by which this age should be known, "Age of Humanity." No age of the world has done so much for humanity at large; sure, there are some minor exceptions, but then all ages have had these more or less. I think that we have the least bad and the most good; so in respect to the numerous things that are done purely out of brotherly love, I think it full time that we call this the "Age of Humanity," and I hope that the benefactors of mankind may go on and never stop, but continue to extend their genial influence from age to age. Here in this ocean life-saving and signal service I think that there is an opportunity for some of our well-disposed millionaires like Peabody, Lick, Cornell, and others of their kind, to establish one of these stations in the ocean. I doubt if their money could be put to any better purpose than in helping carry out some such plan for the benefit of science, and for the additional safety of those who "go down to the sea in ships."

KANSAS METEOROLOGICAL SUMMARY FOR 1878.

BY PROFESSOR F. H. SNOW, METEOROLOGIST TO THE KANSAS STATE BOARD OF AGRICULTURE.

STATION: Lawrence, Kansas. Latitude 38 degrees, 57 minutes, 25 seconds; longitude, 95 degrees, 15 minutes, elevation of barometer and thermometers, 875 ft. above the sea level, and five feet above the ground; rain gauge on the ground; anemometer, 105 above the ground, on the dome of the University building, 1,200 feet above the sea level.

The chief characteristics of the weather of 1878 were the large and well distributed rain-fall, the high average temperature, the absence of great extremes of temperature, the long period of immunity from severe frosts, the comparative lightness of the winds and the low temperature and great snow-fall of the month of December.

TEMPERATURE.

Mean temperature of the year, 55°.33, which is 2°.37 above the mean of the ten preceding years. The highest temperature was 98° on the 15th of July and 24th of August; the lowest was 6° below zero, on the 18th and 25th of December, giving a yearly range of 104°. Mean temperature at 7 A. M., 49°.46; at 2 P. M., 64°.32; at 9 P. M., 55°.31.

Mean temperature of the winter months, 32°.41, which is 2°.79 above the average winter temperature; of the spring, 57°.37, which is 4°.58 above the average; of the summer, 75°.13, which is 1°.20 below the average; of the autumn, 56°.33, which is 3°.87 above the average.

The coldest month of the year was December, with a mean temperature of

23°.05; the coldest week was December 21st to 27th, with mean temperature, 11°.18; the coldest day was December 24th, with mean temperature, 4°.2. The mercury fell below zero seven times, all of which were in December.

The warmest month of the year was July, with a mean temperature of 78°.45; the warmest week was July 10th to 16th, with mean temperature, 83°.90; the warmest day was July 14th, with mean temperature, 85°.6. The mercury reached or exceeded 90° on 35 days, viz: 15 in July, 14 in August, and 6 in September.

The last light frost of spring was on May 14th; the first frost of autumn was on October 18th, giving an interval of 157 days entirely without frost. The last severe frost of spring was on March 4th; the first severe frost of autumn was on October 18th, giving an interval of fully seven months, or 228 days, without severe frost. No frost or cold weather during the year caused any damage to fruit or fruit buds.

RAIN.

The entire amount of rain, including melted snow, was 38.39 inches, which is 3.48 inches above the average annual amount for the ten preceding years. Either rain or snow fell on 107 days. The longest interval without rain during the growing season (March 1st to October 1st), was 12 days, July 8th to July 20th. The number of thunder showers was 38. These occured in all months of the year except November and December. There were three light hail-storms.

SNOW.

The entire depth of snow was 25½ inches, of which 2½ inches fell in February, 1 inch in October, 2 inches in November, and 20 inches in December. The last snow of spring was on March 29th; the first snow of autumn was on October 26th. The single storm of December 12th and 13th brought 14 inches of snow,—this being the greatest snow-fall on our 11 years record.

FACE OF THE SKY.

The average cloudiness of the year was 40.65 per cent, which is 4 55 per cent. below the average. The number of clear days (less than one-third cloudy) 190 half clear, 93; cloudy (more than two-thirds), 82. There were 59 entirely clear, and 37 entirely cloudy days. The clearest month was August, with an average cloudiness of 19.19 per cent.; the cloudiest month was February, with an average of 54.63 per cent. The mean cloudiness at 7 A. M. was 47.32 per cent; at 2 P. M., 44.99 per cent.; at 9 P. M., 29.66 per cent.

DIRECTION OF WIND.

During the year, three observations daily, the wind was from the N. W. 327 times; S. W., 281 times; S. E., 134 times; N. E., 136 times; E., 60 times; S.. 55 times; W., 28 times; calm, 21 times. The north winds (including north-west, north and north-east), outnumbered the south winds (including south-west, south and southeast), in the ratio of 516 to 470.

VELOCITY OF THE WIND.

The number of miles traveled by the wind during the year was 125,793,

which is 16,078 miles less than the average annual distance for the past six years. This gives a mean daily velocity of 344.47 miles, and an average hourly velocity of 14.34 miles. The highest hourly velocity was 60 miles, on April 9th; the highest daily velocity was 919 miles on March 8th; the highest monthly velocity was 15,106 miles, in October. The three windiest months were March, May and October; the three calmest months were February, July and August. The average hourly velocity of the wind at 7. A. M. was 13 44 miles; at 2 P. M.. 16·39 miles; at 9 P M., 14.07 miles.

BAROMETER.

Mean height of the barometer, 29 067 inches; mean at 7 A. M., 29,090 in.; at 2 P. M., 29.047 in.; 9 P. M., 29,063 in. Maximum, 29.735 inches, on December 24th; minimum, 28.335, on April 9th; yearly range, 1,400 inches. The highest monthly mean was 29.268 inches, in December; the lowest was 28.851 inches, in April, The barometer observations are corrected for temperature and instrumental error.

RELATIVE HUMIDITY.

The average atmospheric humidity for the year was 70.4; at 7 A. M., 81.26; at 2 P. M., 50.82; at 9 P. M., 77.22. The dampest month was July, with mean humidity, 78.27; the driest month was November, with mean humidity, 62.60. There were only five fogs during the year. The lowest humidity for any single observation was 18.2, on November 23d.

The following tables give the mean temperature, the extremes of temperature, the velocity of the wind, the percentage of cloudiness, the relative humidity, and the rain-fall, for each month of the year 1878, and a comparison with preceding years:

Months.	Mean temperature.	Maximum temperature.	Minimum temperature.	Miles of Wind.	Mean Cloudiness.	Relative Humidity.	Rain-fall in inches.
January	33 97	55.0	7.5	9.996	47.42	73.40	3.05
February	40.22	66.0	15.5	7.393	54.63	76.50	2.86
March	50.90	81.0	27.0	11.994	40.86	67.64	2.67
April	58.60	82.0	36.0	11.482	38.22	66.03	5.48
May	62.60	85.0	38.5	12.207	52.90	70.90	5.66
June	69.79	89.0	50.0	9.187	48.66	74.80	5.67
July	78.48	98.0	58.0	7.974	31.29	78.27	4.30
August	77.14	98.0	56.0	8.188	19.19	74.60	2.22
September	67.58	94.5	41.0	11.972	30.66	66.40	2.51
October	55.55	87.0	20.0	15.106	28.92	63.70	0.44
November	45.87	72.0	22.0	11.198	42.00	62.60	1.55
December	23.05	53.0	6.0	9.096	55.75	65.70	1.98

COMPARISON WITH PREVIOUS YEARS.

Years.	Mean temperature.	Maximum temperature.	Minimum temperature.	Miles of Wind.	Mean Cloudiness.	Relative Humidity.	Rain-fall in inches.
1878	55.33	98.0	−6.0	125.793	40.65	70.4	38.39
1877	54.16	99.0	−9.0	113.967	47.12	72.6	41.09
1876	52.76	98.0	−5.0	148.120	41.27	66.8	44.18
1875	50.60	99.0	−16.5	145.316	44.81	65.5	28.87
1874	54.20	108.0	−3.0	145.865	45.54	65 5	28.87
1873	52.71	104.0	−26.0	154.508	42.46	64.0	32.94
1872	51.90	97.0	−18.0	.....	44.33	64.4	32.63
1871	54.30	103.0	−6.0	.....	47.37	.....	33.23
1870	54.50	102.0	−10.0	.....	47.88	68.4	31.38
1869	50.90	96 0	−5.0	.....	49.23	.....	38.51
1868	53.36	101.0	−16.5	.....	42.35	.....	37 42

—*Kansas Collegiate.*

KANSAS METEOROLOGICAL SUMMARY FOR JANUARY, 1879.

BY SAML. W. RHODE, SERGEANT SIGNAL CORPS, U. S. A.

The most notable features of the weather during January, 1879, were the high pressure and remarkable low temperature of the first half of the month; the high percentage of humidity and the light precipitation.

The mean pressure of the month was 30.189, which was .04 above the average. The highest barometer was 30.781, on the 3rd, and the lowest 29.596, on the 22d.

The mean temperature of the month was 23.63°, being about 3° below the January average. The highest temperature recorded during the month was 56°, on the 27th; the lowest −14.5°, on the 3d. Lower temperature than this has been recorded at this station in January of previous years as follows: In 1873, −26°, and in 1875, −20°. The greatest daily range of temperature was 35.5°, on the 20th, and the least 5°, on the 28th.

The mean percentage of humidity during the month was 75.79, about 5 per cent above the average for January.

The total rain-fall during the month was 1.16 inches, being slightly less than the January average. The largest rain-fall in January observed at this station, was 3.14 inches, in 1874, and the least 0.13 inches, in 1872. The heavy snow which fell on Dec. 13th, 1878, remained on the ground during the greater portion of January, and is said to be the longest period snow has remained on the ground in this portion of the State since 1856.

The prevailing wind of the month was south. Total number of miles traveled, 4,228; highest velocity, 21 miles, from the north, at 12:30 p. m., 1st.

Two hundred and seventeen observations of the wind's direction were made, as follows: North, 44 times; northwest, 57 times; west, 1 time; southwest, 6 times; south, 66 times; southeast, 12 times; east, 6 times; northeast, 12 times, and calm 13 times.

Number of clear days 10; fair days 9; cloudy days 12 and days rain fell on 7.

The following tabular statement of January mean temperatures and total rainfall will give a comparison of the past month with previous years:

COMPARATIVE TEMPERATURES.	Degrees.	COMPARATIVE PRECIPITATION.	Inches.
1872	25.03	1872	0.13
1873	19.'5	1873	3.02
1874	28.40	1874	3.14
1875	16.70	1875	0.23
1876	35.40	1876	1.42
1877	24.60	1877	0.73
1878	33.80	1878	2.34
1879	23.63	1879	1.16

LEAVENWORTH, KANSAS, Feb. 1, 1879.

MISSOURI WEATHER SERVICE, JANUARY, 1879.

BY PROFESSOR F. E. NIPHER, DIRECTOR.

January, 1879 has been unusually cold. From December 11th to January 15th, the daily mean was constantly below 32° F. During the first decade (10 days) of January, the temperature did not rise above 32° F., the mean temperature of this decade being 9.

The mean of the month was 26°·95 (normal 31.6). Since 1836, the January temperature has been lower than this seven times, the lowest being 19°.3 in 1857. The extreme temperatures of January 1879 were, −14° and 59°, a range of 73°.

The snow-fall of the month was 7.6 inches, the rain (and melted snow) amounting to 1.86 inches (normal 2.17). The ground was covered with snow until January 20th, the snow having been on since December 15th (37 days).

In the State the northern and western parts have received less than one inch of rain. The lower Missouri valley and the extreme southern part having received over two inches. On the 28th (P. M.) a light shower, accompanied with heavy peals of thunder, covered the poorly represented region to the south of the lower Missouri.

At Centreville, 19th at 9 P. M., temperature being 10°, bright starlight, a sound resembling a long peal of thunder, was heard over a region of at least 5 by 10 miles. Possibly subterranean.

The snow-cover disappeared at Neosho 16th, E. Prairie 17th, Lebanon and

St. Louis 20th, Cuba 22d, Pleasant Hill and Harrisonville 25th, Glasgow 26th, Lexington, Booneville and Hamilton 27th, Columbia 28th. The snow-line probably reached the northern limit of the State by the 31st, but the scarcity of stations there makes precise statement impossible. The river opened at Booneville, 29th.

The following low temperatures were observed, all *minus*:

On the 4th, Macon 22, Hamilton 23, Booneville 22, Lexington 17, Harlem 16, Kansas City 20, Harrisonville 20, Columbia 24, Mexico 20, Cuba 19, Lebanon 14.2, Sikeston 4, Jackson 12, Ironton 10. On the 3d, St. Louis 14, Oregon 22, Corning 23, Macon 22, Phelps City 24, Sedalia 20. At Neosho 9 on the 6th.

Buds of peach and raspberry are reported killed at Springfield, and of peach and apricot at Louisiana. At Lexington, along the river, the peach bud is safe, but reported killed six miles from the river.

At Glasgow robins were seen 25th, and blue-birds 28th. The sleighing season ended at Oregon 25th, after a continuance of 50 days.

WASHINGTON UNIVERSITY,
St. Louis, Feb. 5th, 1879.

COLORADO WEATHER REPORT.

SUMMIT, COLORADO,
December, 1878.

Highest temperature, 38°+.
Lowest temperature, 21°—.
Mean temperature, 7°.9+.
Mean of minimum temperatures, 3° 2+.
Mean of maximum temperatures, 20°.3+.
Total snow-fall, 25¾ inches. No rain.
Total melted snow, 2.58 inches.
Prevailing wind, West.
Maximum velocity of wind, 70 miles an hour.
Number of days on which snow fell, 12.
Number of cloudy days, 7.
Number of fair days, 3.
Number of clear days, 20.
Cloudless days, 1.
Depth of snow in inches at close of month, 30.

Two solar halos on 13th; morning and afternoon: latter accompanied by brilliant parhelia.

One of the severest snow storms on record at the Summit ended at 8 o'clock p. m., January 1, 1879, after a continuous duration of 115 hours; during which time the wind velocity averaged 48 miles per hour, and the temperature 7°.2+ Fahr. Total snow-fall, 16 inches.

C. E. ROBINS, V. O.

BOTANY.

LEAVES AND THEIR FUNCTIONS.

BY REV. L. J. TEMPLIN, HUTCHINSON, KAS.

A leaf, whatever may be its configuration or color, is always an object of interest But how few people when they see a leaf as it waves and flutters in the breeze really know what they are looking at. Leaves appear in an endless variety of forms, sizes and colors. They are often so transformed that it is more by the place they occupy than by their forms that we know they are leaves. Underground stems or rhizomas have them at each point or node as little thin scales. Buds are enveloped in peculiar cerements, which generally fall away soon after the ordinary leaves have begun to expand; those enveloping scales are only leaves in a modified form. They are quite prominent in the hickory and horse-chestnut. The scales of bulbs, as of the lily, are simply modified leaves. Flowers are only aggregations of metamorphosed leaves. But it is with leaves as foliage that we are more immediately concerned at present. A complete leaf consists of three parts; the stalk or stem (petiole) on which it rises, the expanded blade or lamina, and two small leaf-like appendages at the base of the leaf-stalk called stipules. The only essential part is the blade, as this may be sessile on the stem without either petiole or stipules. The blade of a leaf consists of three portions; the woody frame-work, ribs or veins, the green cellular portion, pulp, and the outside covering or epidermis. The epidermis, which is really an extension of the outer bark of the stem, is composed of closely-united, transparent cells, with frequent openings through it called stomata or breathing pores. These vary in number from 800 to 170,000 to the square inch of surface. It is through these that water is exhaled from the plant. They are more numerous in the leaves of plants growing in moist situations and surrounded by a damp atmosphere. The pores dilate with the increase of humidity and contract with the increase of aridity. Plants growing in arid climates have but few stomata, and these are very small. While the most of foliage appears to be made on the principle of exposing the greatest possible surface to the air; some forms of vegetation seem to be constructed for the accomplishment of the very reverse of this. Thus the various species of cactus, whose native habitat is the hot, arid plains of the Southwest, are constructed on the principle of presenting the least extent of surface to the air, and this surface is covered with an epidermis that is almost impervious to water. This is necessary to prevent excessive transpiration in that very dry climate. The pulp or parenchyma of the leaf is made up of several layers of cells. These cells are small globular sacks, varying from 1-1200 to 1-250 of an inch in diameter. A layer of these of a rather elongated form

is arranged immediately beneath the epidermis of the upper side of the leaf with the ends to the surface. These are crowded quite closely together. Another layer, not quite so much elongated and less compactly arranged, is found on the under side of the leaf. Between these two layers are numerous globular cells that seem thrown together without any great regularity or order. Among these are numerous irregular passages, intercellular spaces, through which water and air circulate. These reach the surface through the stomata of the epidermis. It is worthy of notice that by far the larger part of these breathing pores are on the under surface, and this surface always seems to avoid direct sunshine. If a leaf is inverted, turning the bottom side upward, it will, if possible, return to its natural position, and if prevented from so doing it will soon die. A few leaves have been known to grow in a vertical instead of a horizontal position. The framework of leaves consists of wood, and is intended to give firmness and support to the leaf. It is divided into numerous veins or nerves that ramify every part of the green parenchyma. There are two distinct systems of venation of leaves: the parallel veined and the net veined. In the former the fibers run nearly parallel from one extremity of the leaf to the other; such leaves are usually long and narrow, linear, as in the grasses, corn, &c. In the other the veins are netted, ramifying the leaf in all directions and dividing the parenchyma into numerous small squares and diamonds. This style of venation exists under two forms; in one a principal vein, midrib, extends from the base to the apex of the leaf, and from this numerous smaller veins branch off and run to the margin; in the other there are three or five nearly equal ribs running the length of the leaf. The first is feather veined from its resemblance to a feather, and the other is palmately veined, the main ribs branching out like the fingers of a hand. The shape of a leaf is generally determined by the manner of its venation. The two principal styles of venation belong to and denote two different classes of plants, the parallel-veined belonging to the monocotyledonous, and the net-veined to the dicotyledonous divisions of the vegetable kingdom. Thus the veining of a small portion of a leaf will indicate to which of these classes the plant upon which it grew belonged.

The green color of leaves comes from a granular substance, chlorophyl, found in the cells of the parenchyma. In its absence no true vegetable structure can be built up from the original elements, and it can operate only in the presence of sunlight. Low cryptogamic plants will grow in the dark, but they contain no proper chlorophyl. Chlorophyl has been found to be composed of two different substances, xanthophyl, a yellow substance, and cyanophyl, a blue material; their union forms chlorophyl, or leaf-green. It is thought that the yellow color of leaves at maturity is caused by the predominance of xanthophyl at that time. Besides chlorophyl the leaf cells contain the proximate principles of the plant, and here the real work of building plant structure is performed. But this brings us to the consideration of the second part of our subject, viz: the functions of leaves.

In treating this branch of the subject, it will be necessary to consider the leaf under several different characters. Leaves should be considered as real living

beings, capable of performing vital functions, as workers performing a large amount of important work. We may first consider *the leaf as a pump*. One of its most important offices is to pump up water from the soil through the roots and stems of plants. This it exhales through its stomata in the form of invisible vapor. By this means a large quantity of water is carried up from the soil to the atmosphere. Thus a large portion of water that would quickly settle down through the deeper soil and find its way into underground passages, is carried up and given off to the atmosphere, where it is condensed into clouds and descends in rain, thus watering and making fruitful the earth. Without this work many parts of the earth that now blossom as the rose would become arid wastes. The amount of moisture thus carried up and exhaled by the foliage of trees and plants is immense. A sunflower, with a leaf surface of 39 square feet, exhaled three pounds of water in twenty-four hours. A corn plant, in about three and a half months, gave off in vapor thirty-six times it own weight of water. A medium sized forest tree will pump up and exhale about five barrels of water in twenty-four hours. This will give about 800 barrels to the acre. An acre of grain or grass will do about the same. From this it may be seen why forests exert such a powerful influence on the rainfall of a country.

Again, we may consider *the leaf as a lightning conductor*. It is one of the most efficient conductors of electricity ever made. Most leaves have notched edges; each of these "points" is powerful to attract the electric fluid from the air and through the stem convey it silently to the ground. A single blade of grass is said to be three times as powerful to attract electricity as a fine cambric needle, and a twig covered with leaves is more efficient than the best constructed "patent point." A tree covered with leaves is the most efficient safeguard from lightning that can be found.

A green tree is constantly conveying electricity from the earth to the air and from the air to the earth. True, it sometimes tries to carry too large a load in response to the efficient collecting power of the leaves. They gather it in faster than the trunk can carry it away and it is bursted. We say the tree is struck with lightning. But it has often been struck before, but this time it was overloaded and crushed. Trees are natural lightning-rods, more efficient than all the artificial ones that have ever been invented.

In the next place we may contemplate *the leaf as an organizer* of organic matter. It is here that it has performed its most efficient and important service for man. Through its agency every particle of both vegetable and animal organism has been either directly or indirectly built up. Every plant, tree and shrub has been directly built up through the labor of the leaf, and every animal, whether fish, reptile, bird or mammal, whether domesticated or wild, useful or injurious, has found its support in the material organized through the labor of the leaf. And even long before the present order of things existed, the leaf was at work. Through its labors vast beds of vegetable matter were laid away far back in the carboniferous ages, which by heat and pressure have become coal, forming vast storehouses of excellent fuel. And still further back in times when silurian seas washed the

shores of limited bodies of land, the leaf was at earnest, ceaseless toil. Thus we owe to the leaf not only what makes life pleasant, but our food and raiment and fuel, without which life would be impossible. Without the leaf as an organizer the earth would sink back into a lifeless, pulseless waste.

Lastly, we may consider *the leaf as a chemical agent*, withdrawing and consolidating various poisonous gases, which if left in the air would render it unfit to sustain life, and thus convert the earth into one vast charnel-house of the dead. The air contains $\frac{1}{2500}$ of its own bulk of carbonic acid, consisting of two equivalents of oxygen and one of carbon. This gas is a deadly foe to animal life, and if permitted to accumulate in the air would soon render it unfit to sustain life. And yet there are certain processes constantly going on that tend to augment the proportion of this gas in the atmosphere. Every breath of every human being and every living animal, and every bit of fuel that is consumed, and every particle of vegetable matter that decays, and every volcano that sends forth its deadly fumes, are adding to the quantity of this gas in the atmosphere. By what agency, then, is the equilibrium maintained? It is through the agency of our little friend the leaf that the work so essential to life and health is performed. It is constantly employed as an analytic chemist imbibing this poisonous gas and analyzing it, using the carbon to build up the organic substance of its own structure, and giving up the healthful, life-giving oxygen to the atmosphere again. This process is so regulated as exactly to keep pace with the liberation of carbonic acid through the agencies mentioned above. Other deleterious gases are thus taken in and rendered innocuous. The blue gum (*Eucalyptus globulus*), of Australia, has become famous for absorbing the deadly gases in miasmatic districts and thus rendering them healthy. Thus the leaf labors preparing food for all living animals, and raiment and and fuel for the lords of creation, as well as all wood and bone and ivory used in the arts. It also purifies the air, making animal life possible, and clothing the earth with beauty that the life thus preserved may be replete with the highest enjoyment.

ON PLANT-DISTRIBUTION AS A FIELD FOR GEOGRAPHICAL RESEARCH.

BY W. T. THISTLETON-DYER, ASSISTANT DIRECTOR OF THE ROYAL GARDENS, KEW, LONDON.

This is a lecture, delivered (we believe) at the Royal Institution, and published originally in the Proceedings of the Royal Geographical Society, London. Its teaching is interesting and truly noteworthy. It tells how "Vegetation in any given spot maintains its own only by having solved the problem of existing in the best way under the given circumstnaces. Introduce a new competitor for a particular site that can solve the problem rather more closely, and the old occupant must needs give way." It intimates that this must

have been so all along geological time, and under all changes of climate, land and sea. It pictures the great hosts of plants oscillating between the poles and the equator, their ranks thinning by "the friction attendant on their movement," which has extinguished perhaps whole battalions. It takes a general survey of the prominent characteristics of the great floras, northern, southern and tropical, and of their principal divisions It brings prominently forward "the opinion that the northern hemisphere has always played the most important part in the evolution and distribution of new vegetable types; in other words, that a greater number of plants have migrated from the north to the south (meaning across the tropics) than in a reverse direction." That proposition (based on the temperate floras) is well sustained by obvious facts, and follows almost of course from the greater amount and longitudinal contiguity of northern lands, as Mr. Darwin has "suspected" But this may probably be limited to the extant vegetation and its nearer predecessors. If the palæonotological botanists are at all correct in their ordinal determinations, the reverse might well have been the case at earlier periods, when Proteaceæ and Laurineæ abounded in northern temperate regions. It must needs have been so if there was for any long period a preponderance of southern land with northward extension.

A good part of the lecture—as rich in practical value as the remainder is in theoretical interest—recounts what geographical explorers have recently been doing for botany by collecting materials and information, indicates how very much is yet to be done in this way, how easy it is to collect and preserve botanical specimens, and what important services the "roving Englishman" and still more the disciplined explorer, may render to the botanical studies.

—*American Journal of Science.*

CORRESPONDENCE.

War Department, Office of the Chief Signal Officer,
Washington, D. C., January 26, 1879.

Editor Kansas City Review of Science and Industry:

My Dear Sir:—At request—or rather suggestion—of Dr. Rae, first discoverer of the fate of Sir John Franklin and his crew, I send you the inclosed paper of his for insertion in the Review. It will be an interesting addition to the next issue. You see the Review is read in England as well as in America.

I send you also an extract from his last letter to me, in which he corrects an error in connection with the finding of the Resolute, as published in the official records. Very truly yours, H. W. Howgate.

LONDON, ENGLAND, 2 ADDISON GARDENS, 6 January, 1879.

DEAR CAPTAIN HOWGATE:—I am this morning in receipt of the Kansas City REVIEW, which you have so kindly sent me, and I have renewed my remembrance of the finding of the Resolute (after her disgraceful abandonment by Belcher's orders) by one of your whalers, and the graceful manner in which she was returned to this country by your government. In your narrative there is only one point to which I take exception, which is the mistake of the gentleman who brought the subject before your Senate, on June 10, 1856.

Mr. Foster states that the Resolute was "abandoned by her officers and crew in Wellington Inlet."

This is a mistake, for the ship was abandoned 120 miles to the west of Wellington Inlet, and had never been in the Inlet at all during the whole voyage.

Belcher, who himself did go up Wellington Inlet, did abandon his two ships there, whilst Kellett, the second in command, went westward. The abandonment of these four (4) perfectly sound and uninjured vessels was only *necessary* and *unavoidable* because Belcher—contrary to the opinion of Kellett and all the other officers—thought it was so. At the court-martial held on the subject, Belcher escaped a severe reprimand by, for him, one lucky clause in his orders. His sword was returned to him in silence.

A great part of the officers and crew were in perfect health, and a number of the former volunteered to remain by the ships with sufficient men to bring them home when the ice broke up, as there was every probability of its doing in a couple of months. Their indignation and chagrin at being refused was extreme.

* * * * * * * * * *

Faithfully yours, JOHN RAE.

THE WALLED LAKES OF IOWA.

PLEASANT HILL, MO., January 26, 1879.

EDITOR REVIEW OF SCIENCE AND INDUSTRY:

DEAR SIR:—In the REVIEW for January you quote an article on "Walled Lakes of Iowa," from a Dubuque paper. The editor of the *Herald* evidently is not conversant with the Geological Reports of his own State, or he would not have inserted such an article in his paper. For explanation, see Geology of Iowa, by C. A. White, vol. I, pp. 74 to 78 inclusive. Prof. White names two such lakes, one in Wright county and another in Sac. They are drift lakes, and similar features, he says, accompany all the drift lakes. He explains: "When a pile of river sand has been left for a long time exposed to rains, the ground, at first scarcely visible, becomes in time even more conspicuous than the sand itself, because the sand is wasted and borne away, leaving the heavier masses of gravel. The ceaseless dashing of a lake stirs up the finer material of the drift which rests beneath the waters. This passes off as sediment at the time of the overflow, leaving the gravel and boulders strewn abundantly upon its bed. The lakes are generally

shallow and the water in them low in autumn, so that at the approach of winter it is frozen to the bottom over a wide margin from the shore." Prof. White states that the walled lake of Wright county a few years ago was entirely frozen and the fish killed, but since partly re-stocked by the fry reaching it by way of the outlet to the rivers at the time of the overflow.

The ice of course freezes to everything upon the bottom, whether boulders, sand, gravel or mud, and the expansive power of the water in the act of freezing is exerted upon them, acting from the center of the lake in all directions to its circumference. Of course it would not be expected that one winter's freezing would bear these boulders to the shore, but it is continued winter after winter, until finally they approach the margin of the lake and repose around it just above high-water mark, forming a ridge just where the expansive power of the water ceased, as shown in many Iowa drift lakes. The tracks of the moving boulders have been observed. Below the line of freezing the boulders would remain unmoved on the bottom.

The embankments vary in height from two to ten feet, and from five to twenty feet or thirty feet across the top, their size varying according to the materials which compose it.

The embankments are often largest on sides opposite to the prevailing winds. Prof. White winds up by saying: "The same material force that brought the boulders down from their northern home, also placed them in the embankments of those lakes, namely, the expansive power of ice." Yours,

G. C. BROADHEAD.

SCIENCE LETTER.

PARIS, December 23, 1878.

The Exhibition, in the matter of domestic heating and lighting, has supplied us neither with anything new nor, indeed, improved, although no end of patents have been taken out, boasting to effect economy in combustion and efficiency in the distribution of heat. Old processes have been brushed up, it is true, but the problem of successful warming of habitations remains unsolved. The ninety-five per cent of heat produced in a fire-place escapes still by the chimney, or, if it is retained in a room to the extent of seventy-five per cent, there is danger of our being suffocated with impure air. Imagine the waste of caloric in a city like Paris, estimated to have 150,000 chimneys. Russia and England displayed very beautiful stoves, but the perfect apparatus was not the less wanting. It is admitted that for a bedroom a chimney is a necessity, but for halls, stair-cases, etc., a stove suffices, provided it be so constructed that the iron shall not acquire a temperature so elevated as to attract the organic particles or germs floating in the atmosphere, and by decomposing them generate that oxide of carbon to be inhaled by us, and thus perhaps profoundly alter the condition of the blood, since Dr. Gréhant has recently demonstrated what poisonous effects an imperceptible trace of that oxide

in the air can produce. Of the boastings to heat large apartments for three sous a day, the public, remembering the price of combustibles, knows full well that from nothing, nothing can be obtained. We waste instead of economizing heat. Dr. Paquelin has applied platina to the production of a constant and high temperature. The system is not new. Platina has the property of condensing gases and vapors, and in proportion as its surface is divided and the temperature elevated. By means of a blow-pipe it can be made incandescent. Dr. Paquelin has made cauterizing instruments, which are easily retained at a uniform somber red, during the performance of his operations, the metal employed being platina, and gas the heating agent preferred. He shows a furnace where inside an iron tube is placed a platina wire, surrounded with stuffings of the same; mineral oil, mixed with air, is blown to the interior, and a heat generated fifty times greater than that of the furnace of a locomotive, and not costing more than 4 centimes—less than a half-penny—per hour.

This apparatus, if the blowing on the wire be augmented, will change the latter from a red to a white heat, and thus obtain a very superior and fixed light. But the jet must be regulated to prevent the melting of the platina. Thus by a mixture of gas and air, or of air and a carbureted vapor, a light can be obtained much superior to that from ordinary gas, and better than that from electricity, as it is from the disagreeable flashes of varied brilliancy. M. Lascols' instantaneous gas is also and old idea, and, if he can obtain its circulation over reasonably long distances, his plan ought to be invaluable for lighting villas, castles and workshops. He can feed several dozen burners. By means of a bellows he drives air into a gas metre at the rate of 1000 quarts in two minutes; thus stored up the air, under a slight water pressure, passes into a reservoir containing mineral essence sufficient to feed fifty nibs during nine hours. By turning a cock, a beautiful flame escapes, lighting with a brilliancy equal to eight candles, and at a cost of a half-penny per hour. There is room clearly for Messrs. Paquelin and Lascols to unite their efforts.

The electric light has made no progress since last year; it is only economical when employed on a vast scale to light up extensive spaces. The sticks of carbon have to be renewed each evening, and this plan, to all appearances, must be continued till Edison produces his platina wicks. Messrs. Dronier and Voisin desire to supersede lucifer matches. When a current of electricity is passed along a platina wire, the latter becomes hot and red; if a lamp containing mineral oil be brought, its vapors, coming in contact with the wire, will be instantly ignited. The pile of Messrs. Dronier and Voisin is powerful and condensed, can be held in the hand and charged every two or three minutes. Such is their *allumeur*.

The prevalence of typhoid fever in French barracks, and the havoc it makes among the young soldiers, gives much occupation to scientific men. Ordinary typhus fever, the consequence of overcrowded habitations, want and general misery, is almost unknown in France. The social condition of the people bars out that epidemic. Not so typhoid, which spares the very young and the very aged, and strikes down the flower of youth and the prime of manhood, indifferent to rank or calling.

The characteristic of typhoid fever consists in the lesions or ulcerations of the intestines, as first pointed out by Spieghel, of Holland, the same doctor who protested against swaddling clothes for infants. It was a Frenchman, Dr. Louis, who in 1829 first employed the term "typhoid"—analogous to, but, as we now know, very distinct from, typhus fever. No remedy has been found for typhoid fever; all science can do is to aid the body by fortifying it to resist the disease and to expel its venomous elements. But man can, by sanitary ameliorations diminish the causes that favor the development, if not produce the disease itself. Continental doctors believe that typhoid fever is both contagious and spontaneous the latter term being employed to cover inability to account for the origin of the disease. There is no doubt the fever is the offspring of a germ, the latter in turn being an excrementitious product, or emanating from the surroundings of a patient, and disseminated by the usual channels of contact, the germ developing when in presence of its peculiar hygienic conditions. We know this germ only by its effects; we are still ignorant of its nature. It is a decomposing matter, suspected of belonging to the class of parisites that produce ferments, such as changing sugar into alcohol or lactic acid, wine into vinegar; and in the case of carbuncle, rot and kindred affections, analgous animalcules have been found. Marshes, sewers, cess-pool emanations, etc., are fruitful sources of typhoid fever, and the track of death is visible following the direction which these currents of contagion take. An insect is often the medium for conveying the disease-seed. Note, however, these facts. Dr. Klein has tried to communicate typhoid fever to monkeys by mixing with their food detritus from a patient; the cess-pool and sewrage men of Paris do not suffer from any typhoid fever, and the cess-pools of this city, cleaned but once a year, have an open grating in the court-yard to allow the noxious gases to escape. In typhoid fever the patient succumbs from the rapid consumption of the tissues, the debris of which float in, while poisoning the blood; when the poisoning reaches the head, stupor ensues, next delirium, then coma, followed by death.

Some confusion exists in the minds of many persons that the solar apparatus exhibited on the Trocaden by M. Monchot, and by means of which he cooked beefsteaks, boiled water to drive a steam pump, to distill cognac, and to manufacture ice, is the same in principle as the burning mirrors or lens of Euclid, Archimedes, De Magini, Buffon, etc. The lens consumed the combustible in a single spot, where the solar rays were reflected and concentrated, and the temperature was so elevated as to melt copper in a few seconds, and burn a hole in a steel spring in nine. The caloric was too intense, too localized, in this case to serve any industrial use; it would fuse in a minute any metal vase, and instantly calcine meats. The sun's rays impart a vast quantity of heat to us, but it is rapidly disseminated and absorbed; the sum of solar heat often equals, per square yard, a quantity sufficient to heat in one minute a quart of water sixty-two degrees Fah. It is for us to capture and imprison it. The gardener does so by his bell glasses. Saussure and Herschel invented the solar pot; the latter, at the Cape of Good Hope, prepared soup in this way. M. Mouchot constructs a reflector, in shape

like an ordinary lamp-shade, and turns the conical mouth to the sun; on the axis of the reflector is an elongated boiler, composed of two envelopes, one for the water, the other for the steam, and both covered with a glass cylinder. This apparatus imprisons the sun's rays when placed at an angle following latitude, and turning with the sun by means of a clock-work movement. There are smaller reflectors, one-fifth of a square yard in surface, that cook two pounds of beef in twenty-two minutes, and that will heat a stove in ninety minutes which would require four hours of an ordinary wood-fire to effect. So late as the 2d of September the grand reflector boiled its seventy quarts of water in half an hour, and in a shorter period, by means of the Carré machine, turned out a respectable block of ice on the principle of evaporation producing cold—one of the objects in watering the streets during summer. There are latitudes, here for example, where the solar receiver would be useless; but as wind-mills are of value in some countries—the coast of Holland for example, so are tropical regions where coal is rare, and sunshine a glut—the Monchot invention might find employment.

The great fishing bank of Newfoundland is equal in extent to one-half the surface of France, and of an average depth of from three to four fathoms. What distinguishes the navigation of the region is that all the dangers of the sea and the atmosphere are there united; the southern winds that there dominate throw over the banks the warm vapors of the Gulf stream, which, encountering polar currents, condense and form a permanent haze, tempered with dense fogs, to be dissipated only by strong northerly or westerly winds. For the same reason, by the shock of waters which takes place, animal matters accumulate, form food, and marine life concentrates there, to devour and to be devoured. Unable to take astronomical observations from a concealed sun—but whose influence not the less dries the fish—and the compass being deranged from a greater proximity to the pole, Vice-Admiral Clone, who commanded several years on the station, has drawn up a handy book called the *Pilote*, being a series of methodical soundings; by following the instructions laid down and constantly heaving the lead, a captain can feel his way as safely as a blind man on shore with a stick.

In the Cevennes, Upper Italy, Bayonne, and even the Azores, the chestnut trees, which are veritable "bread-fruits" for the population, are dying off, the most vigorous in the course of two or three years. The branches wither from the tips, and a dry-rot eats inward toward the trunk. Around the roots is a kind of humid gangrene, sweating a kind of liquid which blackens the soil; this inky color, however, can be produced by the tannin, which the tree contains, coming in contact with salts in the soil. On close examination, a fungus or mushroom will be found to have entwined the roots, stretching its filaments in the new wood of the trunk and branches, and true parasite, living on the sap. The malady is contagious, and recalls the mulberry disease of fifty years ago. Now, all these symptoms coincide with the premature death of the trees on the boulevards of this city, and beneath the grating which runs around the trunks quite a "bed" of venomous mushrooms are ever to be found. The usual explanation given for the perishing of the trees in Paris is the gas pipes and the baking of the ground

by the passing vehicles. But in the exterior boulevards, where gas pipes are as rare as constant traffic, trees decay from their branches inward before their time.

M. Duponchel, in his survey, or rather general investigation, of a proposed grand trunk railway from Algeria to Soudan—the Central African, in a word—has gathered some facts curious for science, though perhaps not likely to catch shareholders. Soudan is just as unknown to Algeria as to France, though there was an active trade carried on between the two countries up to the period of the conquest of Algeria by the French; at present not a person can be found to indicate the routes of the caravansarie. The granitic is the prevailing formation of the Sahara—the latter being an Arab word meaning a soil rocky, hard and resisting; there are also paleozoic and carboniferous beds, justifying the existence of coal, which is totally wanting in Algeria. Railway travelers will be able to enjoy the splendid mirages; they must not expect much vegetation, as this is impossible in consequence of the owners of the air; rain falls, but it is as rapidly evaporated, and the midnight radiation is intense. This projected railway will interfere with the plan of converting the Sahara—of which only one ninth of the surface is in sandy *dunes*—into a sea, its supposed pristine state.

Dr. Blanche, the most famous alienist living, has published a work on dangerous madness, more especially "devoted to those lunatics that kill." He concludes that there is no special form of mental alienation that justifies the name of homicidial monomania; that homicide is only the result of an excitement, which may take place following very different pathologic conditions. Alcoholism and epilepsy represent the maladies where mental perversion most frequently impels to homicide.

Dr. Guerin introduced to the Academy of Sciences a young lady whom he cured five years ago of tubercular consumption. It is the absence of vitality in the lungs that leads to the tubercular deposits; he acts on the thorax by slightly firing the skin near the region of the affected lung, which stimulates it to action. The "fire douche," not painful, is made twice a week, followed with saline and bark preparations.

SCIENTIFIC MISCELLANY.

TELEGRAPHY WITHOUT WIRES.

Mention was made in this correspondence some time ago of the experiments that are being made by Prof. Loomis, of this city, in the mountains of West Virginia, to demonstrate his aerial telegraphy. He claims, it will be remembered, that he can telegraph from one part of the country or world to another without the use of connecting wires, except those that he needs to reach up to a certain altitude, where his experiments have shown that there is at all times a natural current of electricity.

His experiments are conducted from high hills or mountains, though he has

telegraphed as far as eleven miles by having kites raised at each end of that distance, flying them with a fine copper wire instead of string. The instant they reached the same exact altitude or got into the same current telegraphic communication, by aid of an instrument similar to the Morse instrument could be carried on as perfectly as if the two kites were connected by wires. The lowering of one kite would, however, break off the communication immediately. This demonstrated to the professor that his wires should be stationary to keep constant communication.

Accordingly he built a kind of telegraphic tower at the tops of two hills about twenty miles distant, and from them put up a steel rod by which a certain aerial current of electricity was reached. For months at a time he has been able to telegraph from one tower to another. A heavy storm disarranges the connection, but it can be readily restored after the storm has passed. In this respect, however, it is not more unreliable than the ordinary telegraph connections by wire, which are broken up by many storms.

A letter was received from Prof. Loomis some days since by Mr. D C. Forney, of the *Sunday Chronicle*, in which he said that recently he had met with the most remarkable success in his experiments, and had demonstrated by repeated tests that the telephone could be used as easily as the Morse instrument, and that lately he had done all his talking to his assistant, twenty miles away from him, by the telephone, the connection being aerial only.

He added that he had been in correspondence with Edison for a long time, and that he had received many valuable hints from him, and that Edison had been fully convinced for a long time that aerial telegraphy was practicable, and had so expressed himself to him frequently. Edison also thinks that his aerophone can be worked by the same means. It will be readily seen that if telegraphing can be carried on without wires, according to the idea of Prof. Loomis, the expense of the same will be reduced to almost nothing in comparison to the cost of building and keeping telegraph lines in order under the present system.

THE HEAVENS IN FEBRUARY.

Every one who has watched the heavens during January has noticed a gradual shifting of the stars towards the west. Constellations which at the commencement of darkness in the beginning of the month were at an elevation of one-third of the distance from the western horizon to the point overhead are no longer seen, while others, which, at the same period were invisible, have come into view in the East. This movement of the heavens in a western direction is caused by the revolution of the earth around the sun toward the eastern point of the horizon. The sun, though situated at a distances of rather more than 91,000,000 miles, is yet, comparatively, so near that the advance of the earth in its orbit causes the central luminary to appear in different parts of the heavens, while the stars are at such immense distance that even a change of position equal to double the interval between the earth and the sun makes no perceptible variation in their apparent place. Day and night are due to portions of the earth being

turned by its diurnal revolution towards or from the sun, and the increasing or decreasing length of the day causes the stars to be seen in a different position when night renders them visible.

About the middle of February Aries, which is usually considered the first constellation of the zodiac, or of those along the apparent path of the sun among the stars, will be near the western horizon. Aldebaran, a red star in Taurus, and one of the Hyades at 10 o'clock, will be about forty-five degrees high, while Castor and Pollux, in Gemini, will be near the meridian or great circle passing north and south through the zenith or point overhead. Regulus, in Leo, will be about twenty-five degrees from the meridian, and Spica, the bright star in Virgo, and, like Pollux, Aldebaran and Regulus, one of those from which the moon's distance is measured, will just appear in the east. Sirius, "leader of the starry host," will be a little past the meridian; Betetguex and Rigel in Orion, about forty degrees high. Arcturus, in the constellation Boötes, the brightest star visible during the summer months, will be short distance above the eastern horizon. Perseus will be rather low down in the northwest, and Berenice's Hair, conspicuous in the northeast by east, and Capella about sixty degrees high.

As the stars rise an hour earlier every fortnight, their positions at the same time of night vary in that period fifteen degrees, or one-sixth of the distance from the meridian to the horizon. It is therefore only approximately that the places of the brighter stars can be given during the whole month.

Of the planets visible without the aid of a telescope Mercury will be too near to the sun to be observed. Venus will continue to be the evening star, setting each night at a later period and increasing in brightness. Mars will rise about an hour before the sun on the 9th and will be visible a little earlier every morning the remainder of the month, This planet will be in opposition to the sun the second week in November. At such times it is nearest to the earth and shines with the greatest brilliancy. Jupiter will cease to be the evening star after the 7th of the month, and on the 15th will rise a few minutes before the sun, and continue to be the morning star until the close of August. Saturn is approaching its conjunction with the sun. It will set at the beginning of the month a little after 9 o'clock, and may be noticed as a palish star in the southwest. Uranus, which may be observed by a practiced eye shining with a faint blue light, will rise about sunset the middle of the month. It will be near to the waning moon on the 26th and will be visible the whole night. As this planet makes but one revolution around the sun while the earth makes eighty-four, it appears during seven years to rise and set in the same constellation.

Two occultations of stars by the moon will take place in February—one of a star of the fifth magnitude in Scorpio on the evening of the 10th, and another of a small star in Taurus about an hour and a half after sunset on the 28th. The moon will be too near full for the first occultation to be viewed with advantage; the disappearance of the last may be observed at the dark edge of the planet.

The nightly sky during February will be adorned by many of the most beautiful constellations. Stars which have been carefully observed from the days of the

shepherd astronomers of Chaldea to the present time will be visible during the whole or the greater part of every night. Although a majority of the most conspicuous stars are colorless, there are some which present a different aspect. Capella emits an orange, Aldebaran a red, Arcturus a yellow, and Vega a blue light. Sirius, which now appears white, except in certain conditions of the atmosphere, when it has a slightly bluish tinge, was regarded by the ancients as a red star, and it is so called by Ptolemy and Seneca. When it is recollected that each of the colored stars is a sun, which probably gives light and heat to opaque bodies like the earth, imagination fails to picture the hues of a landscape or the tints of the sky on a planet illumined by a red, a blue or a yellow sun. It is also equally at fault in assigning plausible causes for the variation in the color of those "suns of other systems" from the appearance of the central luminary around which the earth makes its annual circuit in its progress through space.

—*Philadelphia Times.*

MAN'S EVOLUTION.

INSPIRED BY THE "FINE OLD ENGLISH GENTLEMAN."

There was a time, devoid of life, devoid of sense or motion,
When nothing stirred—no leaf, no bird, no beast, no fish, no ocean—
Yet, somehow or other, things mixing together, atoms went into spasms and
brought forth protoplasms.
Then sprouted, too, the monkey-man
Of the old Silurian time.

For "cellulous growth" a-working put "to" upon a "pro,"
And "to" and "pro" together combined into "proto,"
Then "proto" with its gaping mouth takes root upon a "plasm,"
And altogether added up somehow turned protoplasms
Into the fine old ancient gentleman,
Of the ante-diluvian time.

His brow was low, his fur was long, his claws had grip of steel,
He roared at megatheriums with uncouth grunt and squeal,
He walked erect or ran about as pleased him, on all fours,
And never a house had he in his life, but lived all the time out of doors—
Did this fine old active gentleman
Of those queer Silurian times.

'Twixt him and his spouse there used to be rows
Which frightened strange beasts to their lairs;
For he'd bang her about with howl and with shout, and pull out her bristly hairs,
And chase her down caves and up into trees, and "paste her delicate snoot."
Thus woman oppressed had her rights first suppressed
By mere physical strength of this brute,

This fine old furry gentleman
Of disorderly miocene times.

Wider his range of appetite the faster he progressed,
He shed his fur, grew tender-skinned, in other skins then dressed.
Cut by sharp flint, he took the hint, and made him knives and spears,
With which he stabbed his fellow-man and skinned the fallen deer.
Unlucky once upon a chase he saw the timid rabbit
Pounced on by wolf, but he was there exact in time to grab it;
And here we see he got an "idee," for the wolf he trained to hunt,
And ever since of sportsman's toil the hound has borne the brunt.

Countless cycles passed away, and then electric flashes,
Consuming woods and game at once, roast meat laid in the ashes,
Which, smelling around, he finally found, and hungry he did eat;
It tasted good, 'twas understood henceforth that roasted meat
Would suit prehensile gentlemen
Of the old post-pliocene time.

The more front brain he grew the more then he knew, and kept on developing "gumption;"
Oft changing his place, his wits grew apace, and with them his demand for consumption;
So to lighten his labors, he stole from his neighbors,
And the pith of the joke is, he called all his tricks his, lawful, correct and legitimate biz-niz!
Did this greatly developed gorilla
Evoluted from pliocene times.

'Tis only a few thousand years since he learned to read and write,
And post his recent history up, as he thinks correct and right,
And fast his angry tongue will wag, and loud his bitter wail,
When told of his progenitors, who by wholesale were re-tailed—
Such a vain, conceited gentleman,
Is he of modern times.

His knowledge now is vast and deep of germs and protoplasms,
Of cosmics here and psychics there, ozones and microcosms.
His science, many syllabled, it strikes one with a thud,
And makes eternal mysteries, as ever—clear as mud!
To the fine old rudimentless man
Of the present high old times.

—*New York Graphic.*

VALUABLE MINERALS IN SAN JUAN.

We have been agreeably surprised with the collection of valuable metallic bearing ores and mineral specimens just opened at 93 Fifth avenue, as received from the great San Juan Mining District of Colorado, and being the property of the recently incorporated Big Giant Silver Mining Company of this city. These specimens are evidently from extensive outcroppings, and give clear and distinct evidence of true fissure veins and ledges. The ores generally are of quartz, porphyry, and feldspar gangue, the metallic contents are as usual in combination with sulphur and oxyds of iron, copper (gray copper) held in finely disseminated atoms. The veins at a greater depth invariably terminate in galeniferous ores, in which the silver largely predominates. Some of these ores contain silver in the metallic state, which is readily visible to the naked eye. It is quite evident that these ores bear a strong resemblance to the famous silver mines of Mexico in the Sierra Madre regions, which have been worked for the past 300 years, and from which many millions have been realized by the British shareholders, as may be read in Jacob's History of Mexico and its Metallic Resources. The San Juan District is of the same upheaval in a geological sense, and is destined to become the great argentiferous emporium of the American continent.—*Occident.*

THE TENDENCY OF MODERN SCIENCE.

In his address at the Harvard commencement exercises recently, Principal Dawson, of McGill College, Montreal, spoke eloquently, but in a vein of modesty rarely equaled by his brothers in science. Mr. Dawson, in the course of his address, said: "There is a temptation in science to attempt an explanation of everything, but the honest way would be to acknowledge frankly its inability to solve the mysteries attaching to certain phenomena. It is a temptation also of scientific men to be drawn toward a materialistic view of nature and man." In thus speaking the learned Professor struck the very key-note of that revolution against the imperiousness of science as at present expounded, which is impending over the whole world of thought. Men of science, like Huxley and Tyndall, for instance, seem to have combined to place literature and history in a position inferior to their own special studies. Huxley has said in effect that the study of the vibriones, and all the remains of the animalculæ, which are the foundation of the bed of the ocean and the chalk cliffs which so often girdle it, are of more importance than any investigation of the habits and history of the great races of antiquity, of the Assyrians, the Egyptians, and their successors in the onward march of civilization among the nations. To judge from many of his works, Tyndall seems to think that the observation of different forms of crystallization is far more momentous than any inquiry into the literature of the Greeks, the polity of Rome or the commercial enterprise of the Carthaginians. In a word, as Mr. Dawson hints, the tendency of all modern science is decidedly in the direction of a cold

utilitarian materialism. It leads men to examine, with the closest attention, not the past and present condition of man *in se* and *per se*, but those forms of inanimate nature or the brute animals, over all of which dominion was given to the human race at the creation. There is, as Tyndall says, infinite poetry even in the dryest details of chemistry and all other subjects of the pursuit of the knowledge of matter. But man, "splendid in ashes, pompous in the tomb," as Sir Thomas Browne says in the *Religio Medici*, is greater than all these. Pope, in many respects one of the greatest figures in the age of Ann, was wiser than these Solomons of science when he wrote: "The proper study of mankind is man."—*Globe-Democrat.*

THE GREAT BRIDGE IN SCOTLAND.

The railway bridge across the Tay, at Dundee, the formal opening of which was celebrated on Friday last with quite warrantable rejoicings, can hardly fail to produce a great effect upon the commerce and manufactures of the northeast of Scotland. Dundee is no longer isolated, and the Firth of Tay, in as far as the railway system is concerned, has been practically abolished. It only remains now to bridge the Forth at Queensferry—a project which has been for some time resolved on—and then the linen stuffs of Borfarshire and Fife, and the farm produce of Aberdeenshire will be brought directly and in an unbroken line within reach of the southern markets. To travelers the through route would be an immense boon, as it would both save time and remove the discomfort of frequent changes.

One of the two ferries that lie between Edinburgh and Dundee has now been superseded, and in such a way as makes it certain that the speedy removal of the other and longer one will be felt to be a pressing necessity. The Tay bridge, however, has something more than a merely local interest. As a triumph of engineering skill and well-directed energy and perseverance, it is worthy of—as, indeed, it has already attracted—very general attention. It is certainly the longest bridge of its kind in the world, and that is a thing of which its projectors and makers are quite entitled to be proud. There are longer viaducts over meadows and marshes, but there is no structure of nearly the same length over a running stream. Its length may be stated broadly at two miles. Including the extension on the northern shore, the exact length is 10,612 feet—that is to say, it is longer than the Victoria bridge, Montreal, and the Britannia tubular bridge taken together. This great length is taken in 85 spans of varying width, the widest (of which there are eleven) being 245 feet. The level at the shore is between 70 and 80 feet above the sea; in the middle it is 130 feet above high-water mark. The skill displayed in a work of this kind is proportioned to the difficulties that were encountered and overcome; and in this view the engineers of the Tay bridge are entitled to the highest praise. In many respects their resources were put to a severe test, but on no point have they failed. The greatest difficulty that met them arose from the varying character of the bed of the river, which compelled them to adapt both the foundation and the superstructure of their piers to the dif-

ferent conditions that pres nted themselves. Near the shores the rocky bed was easily reached, and on it piers were raised built out of brick throughout. Further out it was found that the rock suddenly shelved away to a great depth under clay and gravel. There the cylinders, filled with concrete, which form the foundation, were made of much greater diameter, and above the high-water level iron pillars were substituted for brick. The lattice work girders, as well as the cylinders, were prepared on shore, and were floated out on rafts to their position. The only serious accident that occurred in connection with the undertaking was the bursting of a cylinder within which men were excavating; the water rushed in, and six of the workmen were drowned. The platform on top of the bridge, which carries the single line of rails, is only fifteen feet wide. The bridge does not form a straight line; toward the north end it curves eastward to Dundee. The whole structure has a remarkably light and graceful appearance. It is so long, so lofty, and yet so narrow, that when seen from the heights above Newport it looks like a mere cable swung from shore to shore; and seeing a train puffing along it for the first time excited the same kind of nervousness as must have been felt by those who watched Blondin crossing the Niagara. Fragile as its appearance is, however, there is no doubt of its thorough stability. The total cost of the bridge was £350,000. The cost of the Britannia tubular bridge, which, however, has a double line of rails, was £601,865. The Tay bridge was designed by Mr. Thomas Bouch, C. E. Mr. A. Grothe was the superintending engineer, and the contractors were Messrs. Hopkins, Gilkes & Co., of Middlesborough. Mr. Bouch is at present completing his plans for the Forth bridge at Queensferry. The great difficulty to be overcome there is the enormous depth of water. The width of the strait is more than a mile and a quarter, and almost the only foundation for piers that can be counted on is a small island near the northern shore. The girders in this case must be of unprecedented length.—*London Times.*

HOT LAKES IN NEW ZEALAND.

After a substantial colonial breakfast, consisting of mutton in various forms, we went down a winding path to the lake, and found that the chief to whom we had applied had supplied us with a substantial, English-built boat and a crew of six men, who did no injustice to the Maori fame for stature and strength. We at once embarked, and in less than two hours we landed on the other side. The warm stream that flowed from the hot lake above was too rapid to contend against in anything but light canoes, and having laden two of the crew with our luncheon and rugs, we proceeded to walk the remaining mile to the White Terraces. The scenery already was pretty enough, but we were quite unprepared for the wonderfully beautiful sight which suddenly burst upon us as we turned the last corner. A vast marble staircase rose above us streaming with water. At the summit

a cloud of steam came rolling slowly up from some gigantic boiling pool and floated away among the hills.

We were soon at the foot of the hill, and a nearer inspection only enhanced its beauty. The broad, flat steps were worn by the action of sulphuretted water into an exact imitation of white coral, and on every platform rested a basin of the bluest, clearest water. As each of these was filled from the basin above, it overflowed into the basin below, and from being at boiling point at the top the water became almost cold at the bottom. The pool was almost regularly circular and hollow by nature, so exactly that its sides might compare favorably with the best paved bath in London. A mass of clear, blue water writhed and tumbled within, now rising with a burst to the height of some twenty feet, now sinking into a furious whirlpool.

AMONG the various explorations in the arctic regions prosecuted during the year 1878, not the least interesting and important is that of Lieutenant Jensen, of the Danish navy, in Greenland. As long ago as 1751, Dalager, who made an expedition to Fredrikshaab, reported that far to the east he observed a series of mountain peaks, which he supposed to be the eastern coast of Greenland. Several attempts have been made to reach these mountains, and to confirm or disprove the supposition; but it was not until the present year that this was accomplished. Lieutenant Jensen, with three Danes and one Greenlander, entered the ice-fields on the 14th of July, dragging their provisions and instruments on three small sledges. After very great vicissitudes the party finally succeeded in reaching the mountains, and in ascending the highest of them on the 31st of July. Its altitude proved to be about 5,000 feet above the level of the sea, and the vision swept over ice-fields and hommocks to an indefinite distance, showing conclusively that this was not the eastern coast of Greenland, as had been imagined.

The summit of the mountain ascended by Lieutenant Jensen was bare, thus, according to Mr. Robert Brown, establishing the interesting fact that there are peaks in the interior so high that the great ice sheet has not been able to cover them. He also states that there are no grounds for believing that the inland ice of Greenland comes, like ordinary glaciers, from mountain ranges.

JOHANNESEN, a well-known Norwegian walrus-hunter, has lately discovered a new island, due north of the Yenisei River, in longitude 81° E. and latitude 77° 55′. This is quite flat, and about twelve miles long, with its highest point about one hundred feet above the sea-level. No snow was discerned on the island, which was provided with scanty vegetation, but frequented by innumerable birds. The fact that the sea was free from ice to the west, north and east, and the occurrence of certain types of animal life, suggests the idea that the Gulf Stream reaches the western side of the island. The island, which Johannesen named "Ensomhaden" (*Loneliness*), is almost due east of Francis Joseph Land, and is thought to be a part of the same archipelago.

EDITORIAL NOTES.

THE Kansas City Academy of Science was addressed at its last meeting, January 28, by Prof. C. E. Robins, of Colorado, whose very entertaining paper upon "Life at the Timber Line" will be found in this number of the REVIEW.

Mr. A. Greeley also read a very interesting essay upon "Human Progress," which evidenced deep and extensive research and an unusually perspicuous and elegant style of composition. The positions taken by him were freely discussed by Prof. Parker, Dr. Halley and others.

Mr. Wm. Lykins presented to the Academy about fifty volumes of bound and unbound scientific magazines and pamphlets, which were accepted with a vote of thanks.

THE Kansas State Historical Society elected as a Board of Directors: S. A. Kingman, C. Robinson, D. R. Anthony, C. K. Holliday, J. C. Hebbard, D. W. Wilder, G. A. Crawford, J. A. Martin, Sol. Miller, E. N. Morrill, Jacob Stotler, F. P. Baker, F. G. Adams, J. P. St. John, John Francis, A. H. Horton, P. I. Bonebrake, T. D. Thacher, B. F. Simpson, J. F. Legate, John Speer, S. N. Wood, M. W. Reynolds, J. L. McDowell, J. M. Harvey, P. B. Plumb, J. J. Ingalls, W. A. Phillips, D. R. Smith, Chas. W. Leonhart, D. E. Ballard, W. W. Guthrie, George Graham, James Blood, A. G, Barrett, Robert Crozier.

Gov. Chas. Robinson, who selected the town site of Lawrence for the first organized party that ever came to Kansas, was unanimously elected President.

D. R. Anthony, who a quarter of a century ago conducted the original party from the East to Lawrence, was chosen one of the Vice-Presidents, and Col. C. K. Holliday, one of the earliest pioneers, and who did able service for the people of Kansas, was also chosen Vice-President. F. G. Adams, the efficient Secretary, was unanimously re-elected Secretary, and John Francis Treasurer.

THE report of the Entomological Commission, consisting of Profs. Riley, Packard and Thomas, is a monument of patient study and scientific accuracy, of which the authors may be proud, and for which the whole country may rejoice. It is the result of only one year's work, but it goes so far to determine the habits of the Rocky Mountain locust and to specify means for its extermination, that little more seems to remain possible to be done.

PROFESSOR BERTHOUD, of the Colorado School of Mines, at Golden, Col., writes us that "it is proposed to have a vacation course this summer, in which the students will visit, besides the pleasure resorts, all of the principal mines and works in the State, remaining long enough at each for thorough instruction in the details of the various mining and metallurgical processes. This course will be under the immediate direction of the Professor in charge, and of the Professor of Geology. An endeavor to obtain special excursion rates on the various railroads over which the students will travel will be made, in order to render the expense of this trip as small as possible. The course will be open to others than those who are students at the Institution, and any one desirous of taking the excursion without pursuing the regular course of studies in the school, may do so. This offers an excellent opportunity to students in the Eastern colleges to spend their vacation in a manner which will be both agreeable and of benefit."

A CONVENIENT HAND-CAR.—A light hand-car built by the Westinghouse Air-brake Company has been named the "Quadricycle." It weighs 350 pounds; the rear wheels, or drivers, are four feet in diameter, and the pilot-wheels two feet in diameter—these latter being purposely made small to keep the vehicle on the track, and to enable the rider to lift the front end and drag it from the track quickly in the event of meeting a train. One has been running for a month or two between Steubenville Junction, on the Pittsburg, Cincinnati & St. Louis Railway, and Wheeling, a distance

of twenty-seven miles, which it makes at an average speed of ten and a half to twelve miles per hour, carrying sixty pounds of newspapers. Instead of being worked by a crank or cranks by one or more persons, this machine is worked by a cross-bar, from which levers extend to each of the four wheels. The applicative hand-power is very effective, and makes a single person accomplish handsome results in fairly-tested transportation of himself, and with him considerable weight.

PROF. B. F. MUDGE, the well known Geologist and Palæontologist of Kansas, returned a few days since from a lecture tour In New England to his home at Manhattan, stopping a few hours only in this city.

THE citizens of Penzance, England, celebrated the birthday of Sir Humphrey Davy on the 13th inst. with appropriate ceremonies and a display of scientific apparatus and electric lights.

THE Congressmen from Kansas and Colorado are earnestly opposing the geodetic survey recommended by the National Academy of Science.

NOTES ON THE PERIODICALS.

THE *London Quarterly Journal of Science* does us the honor to republish from the November issue of the REVIEW the now widely-read article on "Peruvian Antiquities," by Dr. E. R. Heath, of our sister city, Wyandotte, Kansas.

This able and long established journal is to be changed with the next number from a Quarterly to a Monthly and its scope extended so as to include new branches and divisions of science and enable it to keep more nearly abreast with the progress of scientific research and discovery.

Popular Science Monthly for February contains: Darwin *vs.* Galiani, by Prof. Emil Du Bois-Reymond; Scientific Relation of Sociology to Biology, II, by Prof. Joseph Le Conte; The Crystallization of Gold, Silver and other Metals, by Thomas J. Gregan (Illustrated); Herbert Spencer before the English Copyright Commission, II; The Formation of Mountains (Illustrated); Planetary Rings and New Stars, by Prof. Daniel Vaughn; The Old Phrenology and the New, by Dr. Andrew Wilson (Illust'd). Backgammon among the Aztecs, by Edward B. Tylor; Mites, Ticks and other Acari, by E. R. Leland (Illustrated); Typhoid Fever Poison, by Eli Van de Warker, M. D.; Sketch of Elisha Gray, by George B. Prescott (With Portrait); Correspondence; Editor's Table; Literary Notices; Popular Miscellany; Notes.

A. S. BARNES & CO. contradict the current report that Messrs. Lodge & Morse have bought the *International Review* and are about to remove it to Boston for publication, stating that they have not sold it to anyone, and that the arrangement with Messrs. Morse & Lodge is merely editorial-

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THE *Atlantic* for March will give the first place to a paper of political and scientific interest, entitled the Natural History of Politics, which will be followed by an excellent short story; an essay on New York Theaters; an account of Unification in the Pitcairn Islands, by Mark Twain; an article on Electioneering in Congress for 1880; the conclusion of Mr. Howell's story; and other essays, tales and sketches.

The February number contained reduced heliotype reproductions of the four life-sized portraits of distinguished American Poets, which are offered to subscribers and purchasers, for one dollar each. They are the work of Mr. J. E. Baker, one of the best crayon artists in America, and have received the hearty indorsements of such competent judges as Dr. O. W. Holmes, R. W. Emerson, C. D. Warner, T. B. Aldrich, G. W. Curtis, Bavard Taylor and others.

THE February number of the *North American Review* opens with an article by Senator Hoar on the Conduct of Business in Congress, which calls attention to the defects in the present system of transacting business in the national legislature, and suggests improved methods; A Statesman of the Colonial Era, by Gen. Richard Taylor, describes the career of George Mason, of Virginia, and attributes to that gentleman many sayings and writings

that have hitherto been credited to other men; Hon. D. H. Chamberlain writes on Reconstruction and the Negro, and presents the results of his experiences and observations while occupying the gubernatorial chair in South Carolina; the Scientific Work of the Howgate Expedition, by O. T. Sherman, of the scientific corps, gives a very full statement, and the only one that has been presented to the public, of the scientific results of the recent government preparatory expedition to the polar seas; Sensationalism in the Pulpit, by Rev. Dr. Taylor, of the Broadway Tabernacle, New York, a pungent criticism of the theatrical tendencies of certain preachers; and many other excellent articles.

Published at 551 Broadway, N. Y., and for sale by booksellers and newsdealers generally at 50 cents per copy.

HARPER'S MAGAZINE for March offers an unusual variety of matter to its million readers, while it contains no article that is not especially noteworthy; and its illustrations, of which there are eighty-five, are remarkable examples of the best style of wood-engraving. It contains, among other excellent things: Present Tendencies of American Art, S. G. W. Benjamin; A Few Sea Birds, H. W. Elliot; The Coast Survey, Martha J. Lamb; The English Home of the Washingtons, A. T. Story; Our Dutch Masters, I. Rembrandt Van Ryn, E. Mason; The Pine-Tree, a Poem, Harriet Spofford; Burg und Thal, Sketches in Tyrol (I.), George E. Waring, Jun.; English and American Locomotives, Charles Barnard; A Summer Story, Alice Perry; The English in India, Thomas Knox; Climates for Invalids, Dr. T. M. Coan; Gary's Magnetic Motor, E. M. Bacon; The "Tom" Side of Macaulay, D. D. Lloyd; Miss Morier's Nerves, a Story, Miss Thackeray; Afghanistan, Z. B. Gustafson; Editor's Easy Chair; Editor's Literary Record; Editor's Historical Record; Editor's Scientific Record—Astronomy, Physics, Chemistry, Anthropology, Zoology, Engineering and Mechanics.

OUR friends of the *American Journal of Science* spell *loëss* with a diphthong, thus, *lœss*. Where they find authority for this we do not know. The derivation of the word is usually attributed to the German *lösz*, which gives apparent ground for the innovation, though no other scientific work has adopted it as far as we have observed.

THE *Price Current* of this city has issued its annual *Review* of the trade and commerce of this city in the shape of a handsomely printed pamphlet on tinted paper and filled with the most carefully prepared statistics of all the various branches of business carried on in Kansas City. Mr. Hasbrook, the compiler, and editor of the *Price Current*, has evidently given a great deal of time and careful study as well as arduous labor to its preparation, and it is a credit to him in every way, while at the same time it is a record of our business progress that every citizen may be proud to aid in distributing.

THE *American Antiquarian*, an illustrated quarterly journal, devoted to early American history, archæology, and ethnology, edited by Rev. Stephen D. Peet, Ashtabula, Ohio; published by the Archæological Exchange Club, $2.00 per year or 50 cents each number, is the only magazine of the kind on the continent. The articles are all interesting and contain accounts of the latest discoveries. The illustrations are quite wonderful; they picture ancient things of which we now know but little. The researches are entirely reliable, as the list of contributors will show, viz: Dr. Charles Rau, D. C.; Dr. S. S. Haldeman, Pennsylvania; Prof. E. A. Barber, Pennsylvania; Prof. M. C. Read, Ohio; Col. C. Whittlesey, Ohio; C. C. Baldwin, Ohio; Wm. N. Byers, Colorado; F. F. Hilder, Missouri; Dr. J. D. Moody, Illinois; Hon. R. S. Robertson, Indiana; Col. L. J. Dupre, Texas; A. F. Berlin, Pennsylvania; Hon. C. C. Jones, Georgia; C. Berthoud, Dakota; E. F. Williams, Minnesota; Rev. H. F. Buckner. D. D., Indian Territory; Rev. M. Eells, Washington Territory; Prof. R. B. Anderson, Wisconsin; Hon. J. D. Baldwin, Massachusetts; L. Andrews, Connecticut; Hon. Bela Hubbard, Michigan.

Sunday Afternoon improves upon acquaintance, and we can give it a hearty recommendation to all who desire a good, high-toned intellectual Sunday magazine.

Of the many Guides and Seed and Plant Catalogues sent out by our seedsmen and nurserymen, and that are doing so much to inform the people and beautify and enrich our country, none is so beautiful, none so instructive as *Vick's Floral Guide.*

Books and Pamphlets Received:—*Public Libraries in the United States;* Parts I and II, being a report on their history, condition and management, by John Eaton, Commissioner of the Bureau of Education, Department of the Interior, Washinton, D. C. pp. 1187, octavo; *Report of the Commissioner of Education*, 1876, Parts I and II, by John Eaton, Commissioner: Government Printing Office. pp. 492; *Report of the Agricultural College* of Missouri, by Prof. G. C. Swallow; *Our National Waterways*, a speech of Hon. William Windom, of Minnesota, June 10, 1878, in the Senate of the United States; *B Lionis and B A. C.*, 3992, and *Note on the Duplicity of the Companion to Rigel*, by Prof. S. W. Burnham, of Chicago, reprinted from the monthly notices of the Royal Astronomical Society, May, 1878; *Catalogue of the Publications* of the U. S, Geological and Geographical Survey of the Territories, by Prof. F. V. Hayden, revised to Dec. 31, 1878; *Automatic Cerebration*, as related to cerebral localizations, by Prof. J. K. Bauduy, M. D., a discussion thereof in the Association of Medical Superintendents of the American Institutions for the Insane, St. Louis, 1878; *Chinese Exclusion*, speech of Hon. Jas. J. Ayers, Los Angeles Cal., Dec. 9, 1878; *Unconscious Tuition*, by Rt. Rev. F. D. Huntington, S. T. D., Bishop of Central New York, being the first of "School-room Classics," published by Davis Bardeen & Co., Syracuse, N. Y., pp. 45, 15 cents.; Some Early Notices of *Indians in Ohio*, and a discussion of the question, *To what Race did the Mound Builders belong?* by A. M. Force, pp. 75, octavo. Robert Clark & Co., Cincinnati. 50 cents.

Lindsay's Luck, by Mrs. Frances Hodgson Burnett, T. B. Peterson & Brothers, Philadelphia, is a charming tale, a delightfully fresh creation, pure in sentiment and action, full of force and dramatic power, and is a love story of the very best and purest kind. It will have a large sale, as its price is but 25c a copy. For sale by all booksellers and news agents, or copies of it will be sent to any one, to any place, post-paid, on remitting 25 cents in a letter to the publishers, T. B. Peterson & Brothers, Philadelphia, Pa., or to the Kansas City Book and News Co.

New Periodicals received, of which ample notice will be made hereafter: *Deutsche Geographische Blätter*, edited Dr. M. Linderman, Bremen. *Index Medicus*, a monthly classified record of the current medical literature of the world, compiled under the supervision of Dr. John S. Billings, U. S. A., and Dr. Robert Fletcher, M. R. C. S.; N. Y., F. Leypoldt; 72 pp., $3.00. *Our Schools*, a monthly journal devoted to the advancement of educational interests; Lawrence, Kansas; 60c per annum. *The Normal Courier*, edited by C. W. Stevenson, at the State Normal School, Warrensburg, Mo.; $1.00 per annum. *The New West*,, monthly, H. H. Allen, Atchison, Ks., editor; 60c. *Robinson's Epitome of Literature*, F. W. Robinson & Co., Philadelphia, devoted to literary criticism, art, music and the drama; $1.20. *Illustrated Scientific News*, S. H. Wales & Son, New York; semi-monthly; $1.00. *Carpentry and Building*, monthly; David Williams, New York; $1.20. *The Beacon*, monthly; Beacon Publishing Company, Philadelphia; 25c

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PREMIUMS TO SUBSCRIBERS.

We have determined to adopt a new, and, as we think, appropriate and acceptable plan for giving premiums to our subscribers, viz:

To any person who sends us $3.50, we will send the Review for one year and any $1.50 book published by D. Appleton & Co., S. C. Griggs & Co. Robert Clark & Co., Houghton, Osgood & Co., Roberts Bros., or J. B. Lippincott & Co.

To any one sending us $3.75, we will send the Review for one year and any $2.00 book published by any of the above.

Persons desiring to subscribe for the Review and purchase any book or books or subscribe for any other periodicals published or obtainable in this country, can obtain special rates by applying to the editor in person or by letter.

Clubs desirous of subscribing for the Review can have the same privilege as single individuals, besides the advantage of reduced rates of subscription.

To persons wishing to purchase law, medical, scientific or miscellaneous books, and at the same time subscribe for a periodical which includes within its scope popular articles upon all branches of science, mechanic arts and literature, we deem this a particularly favorable offer.

BACK NUMBERS.—To any subscribers for the coming year we will furnish the back numbers of the first and second year for $2.25 each, bound, or $1.25 each unbound.

TESTIMONIALS.

AS THE second volume of the REVIEW will close with the next number, March, 1879, and we shall be asking our friends to renew their subscriptions, it may be well enough for the first time in its history, and by way of showing the estimation in which it is held among scientific men and periodicals in different parts of the country, to publish extracts from some of the pleasant and encouraging letters and notices we have received. From them it will be observed that the REVIEW has met with favor not less in the East than in the West, and that even in Europe it has found some readers of note who have been kind enough to express their appreciation of it and its management:

Washington, Jan. 20, 1879.

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I look upon your REVIEW as a very valuable addition to scientific journalism, and one especially interesting to the growing West.

Very truly yours,
H. W. HOWGATE, U. S. A.

St. Louis, Nov. 4, '78.

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It will give me pleasure to do anything in my power to further your enterprise. Your journal is excellent and most creditable to yourself and the Great West, and much prized by your obedient servant, A. J. CONANT.

Topeka, March 29, 1878.

* * * The REVIEW is a very useful publication, and must contribute very sensibly to the material development of this section of the country, a record of whose history and development it is the object of this society to make up. Yours very truly, F. G. ADAMS,
Sec'y Kansas State Hist. Society.

Academy Natural Sciences,
Philadelphia, April 23, 1878.

I regret to-day that the March number of your valued journal has not been received at the Academy. Will you have the goodness to supply a copy, that our set may be kept complete? Yours truly,
EDW. J. NOLAN, Sec'y.

Prof. E. T. Nelson, Wesleyan University, Delaware, Ohio, writes. Dec. 1, 1878, as follows:

"I have just read the November number of your monthly with great pleasure and profit. I did not know that so interesting a journal was published in the West."

Prof. O. T. Mason, Columbian College, D. C., the distinguished American anthropologist, writes, Jan. 20, 1879:

"I have frequently promised myself the pleasure of showing my appreciation of your very creditable journal by sending you something from the foreign field, &c."

Hon. B. B. Cahoon, of Fredericktown, Mo., writes, Jan. 30, 1879:

"I am much pleased with the Review, and it is well worth the subscription price ($2.50), which I inclose to renew mine."

Boston Scientific Society,
January 31, 1879.

With thanks for kindness in sending your Review to our society and congratulations upon the high standard it has reached, I am,
Ever yours,
J. RITCHIE, JR., Sec'y.

THE last number of THE WESTERN REVIEW OF SCIENCE AND INDUSTRY will compare favorably with similar monthlies issued in the East and making much greater pretensions. Its selections are the best, and in every department is exhibited an editorial ability which does great credit to the publication. This number closes the first volume, and we trust that, in the future, a proper recognition will be extended the publisher in his efforts to establish a first-class magazine.—*Price Current, March* 18, 1878.

THE KANSAS CITY REVIEW OF SCIENCE AND INDUSTRY. Edited by Theo. S. Case. Price $2.50 per annum. Single copies, 25 cents.

The editor of this popular monthly has for this issue, Sept. 1878, adopted the enterprise of the daily press, in giving at length the proceedings of the American Association for the Advancement of Science—months in advance of any other magazine and of the official record itself.—*K. C. Journal.*